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Analysis of longline size frequency data for the 2025 southwest Pacific swordfish assessment and revised 2024 southwest Pacific striped marlin assessment

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Executive Summary

This Information Paper describes the pre-processing of size composition data prior to integration into the 2025 stock assessment model for southwest Pacific swordfish and the revised 2024 assessment model for southwest Pacific striped marlin, and provides a comprehensive summary of reweighted size compositions and their associated input sample sizes.

The reweighting of size compositions for assessments of Western and Central Pacific Ocean tuna and billfish stocks has historically been complicated by unrepresentative coverage of size samples, temporal changes in the coverage of size samples between fleets within assessment model fisheries, as well as temporal changes in their contributions to catches. This can result in temporal variability that is driven by changes in sampling, rather than changes in the size composition of catches or the underlying population. A key area of focus for this assessment cycle was exploring the use of alternative data filters to attempt to improve reweighted size compositions, in particular to further remove apparent noise and temporal variability in fishery-level size compositions driven by limited or unrepresentative sampling. These new filters included:

- Filtering for samples from fleets that contribute a minimum proportion of the catch for fishery and year-quarter, to ensure that fleets making a minor contribution to catches were not influential on an assessment fishery's compositional inputs for mixed fleet fisheries.
- Filtering for samples from fleets that have a minimum number of samples for a fishery and year-quarter, to minimise the propagation of noise in compositions at a fleet level through to an assessment fishery-resolution.
- Filtering for fishery and year-quarter combinations with a minimum number of samples, to reduce noise in assessment fishery-resolution inputs.

The reweighting procedure and filtering rules lead to substantial improvement in compositional inputs, but there was still appreciable levels of apparent noise due to the relatively low sample sizes for swordfish and striped marlin which are typically incidentally caught.

1 Introduction

This Information Paper describes the pre-processing of size composition data prior to integration into the 2025 assessment model for southwest Pacific swordfish (Day et al., 2025) and the revised 2024 stock assessment model for southwest Pacific striped marlin (Castillo-Jordán et al., 2025). Statistical correction of size composition data is required as samples are often collected unevenly in space and time. As such, the samples require reweighting using either catch, to be representative of the size of fish being removed from the population in the case of extraction fisheries, or estimates of relative abundance, to be representative of the size of fish in the population in the case of index fisheries. This reweighting procedure was applied to size compositions of longline fisheries.

2 Methods

The procedure for extraction and index fisheries was based on the approach used to prepare longline size compositions for the 2024 striped marlin assessment (Castillo-Jordán et al., 2024), which was developed from the approach of McKechnie (2014) and Tremblay-Boyer et al. (2018) for extraction and index fisheries respectively. The region specifications are provided in Figure 1, with fishery definitions provided in Table 1 & Table 2 for swordfish and striped marlin, respectively.

2.1 Data preparation

Available length and weight samples from SPC's LF MASTER and WT MASTER databases were extracted. Size samples and aggregate longline catch data were matched, and aggregated to, consistent fleet groupings using lookup tables held by SPC's Data Management team. 'Fleet' refers to the combination of vessel flag and fleet sector, for those fishing nations with distinct fleets in reported size data and catch and effort data. The size samples and aggregate catch data were then aggregated to a year-quarter temporal resolution to match the structure of the assessment model.

Length data for striped marlin have been provided to SPC based on four different length measurement methods: eye orbit-fork length (EFL), lower jaw-fork length (LJFL), bill tip-fork length (BFL) or pelvic fin-fork length (PFFL). A range of weights were supplied including whole weight, Japanese processed weights (gilled, gutted, head and tail left on, bill removed at a point level with the tip of the lower jaw), and gilled, gutted and headed (i.e. trunked) weights. All length measurements were standardized to EFL and weight measurements were standardized to the equivalent whole (unprocessed) weight using the conversion factors listed in Williams and Smith (2018); Hamer et al. (2025). Length and weight data for swordfish were treated similarly, but with lengths converted to lower jaw-fork length which is the unit of length measurements used for this species.

Size compositions for striped marlin were prepared with 63 5cm length classes covering the range 20 to 335cm (with lower limits 20cm, 25cm, . . . , 330cm), and 123 2kg weight classes covering the range 5 to 251kg, with lower limits 5kg, 7kg, . . . , 249kg. Length compositions for swordfish were prepared with 29 10cm length classes covering the range 30 to 320cm. Weight compositions for swordfish were prepared with both (63) 5kg weight classes covering the range 2 to 312kg, and a set of (30) weight classes with varying interval widths, with lower limits 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 200 and 250kg. Statistical tests were applied to the swordfish weight data to ensure that data reported as having 1kg weight classes was not contaminated with size data with larger intervals (e.g., 5kg), based on those used in the preparation of striped marlin compositional inputs in 2024 (Castillo-Jordán et al., 2024). These tests did not detect appreciable levels of apparent contamination at either 2kg or 5kg resolutions, providing some confidence that it was not inappropriate to use 1 and 2kg size classes for the smallest fish.

The reweighting procedure was implemented at a 10 x 20° spatial resolution. However, 10 x 20° cells can span multiple assessment regions, as well as the boundary of the spatial domain of the assessment model. As an initial step, striped marlin size samples were aggregated to a 10 x 20° and region spatial resolution as follows:

1. All size samples were split to a 5° spatial resolution using the proportion of reported catches of striped marlin (numbers) by 5° degree cell for a given year-quarter and fleet. For example, size samples provided at a 10 x 20° resolution would be split between a maximum of eight 5° cells.
2. The 5° cells were then assigned to an assessment model region, and any 5° cells outside the spatial domain of the assessment model were excluded.
3. The size samples in each region were then aggregated back up to a 10 x 20° and region spatial resolution, i.e. an overall resolution of year-quarter, region, 10 x 20° cell and fleet.

An equivalent approach was used to aggregate swordfish size samples to a 10 x 20° and region spatial resolution.

2.2 Investigation of differences in size compositions between data sources

As part of a review of available size compositional data for southwest Pacific striped marlin and swordfish, we compared length compositions for key fleets between data sources, to identify any discrepancies that may point to data quality issues or other potential sources of bias. PICT fleets typically have good coverage of length samples collected by both observers and through regional port sampling (data source 'SPLL'), enabling comparisons by data source. For both striped marlin and swordfish, there were a larger proportion of smaller individuals in observer data compared with port sampling data (Figure 2 & 3). A detailed look at fate codes and comments in the observer data indicated that some of these smaller fish were retained for crew consumption. This suggests a sampling bias in the 'SPLL' port sampling data. There was also a suggestion of a similar bias in regional port sampling (SPLL) data for other fleets, though the coverage of SPLL data was more limited. It was not possible to undertake comparisons against other port sampling datasets, as these were typically provided to the Pacific Community as part of aggregated data submissions in combination with other data sources.

Comparisons of size compositions between observer programmes for key fleets did not identify other discrepancies between data sources.

To mitigate against bias in size compositions, the following approach was taken with respect to SPLL data:

1. Swordfish – Separate length compositions were constructed for PICT extraction fisheries using observer samples only, and port samples only, to allow model fits to be inspected for each data source in isolation. PICT index fishery compositions were based on observer samples only. SPLL samples were excluded for all distant water fleets.

2. Striped marlin – SPLL samples were excluded for all fleets, noting that there is no separation of PICT and distant water fleets in the assessment.

2.3 Initial data filtering

The following data were removed prior to the reweighting of size compositions for striped marlin, based on targeted examination of size data following the 2024 assessment:

1. Aggregate length data submissions from Taiwan (data source 'TWLL'), as it includes data measured by eye by skippers and crew (Hamer et al., 2025).

2. Australian length data (collected by observers), which is considered less representative than available weight data (collected through port sampling) due to observer sampling biases.

3. Anomolous Japanese length samples from the first quarter of 1995.

4. For fishery '02.LL.JP.2', excluding anomolous weight data from 1975 to 1979, and 1998 onwards.

5. Anomolous Japanese weight samples from region 3 in the first quarter of 1987.

6. For fisheries in region 4, excluding length collected before 2007 which includes anomolous small fish.

Similarly, the following data were removed prior to the reweighting of size compositions for swordfish:

1. Aggregate length data submissions from Taiwan (data source 'TWLL'), and Australian length data, for the reasons outlined for striped marlin.

2. EU length samples from 2010 onwards, due to unexplained shifts in size compositions coinciding with a reduction in the coverage of length samples.

3. Regional port-sampling data (SPLL) for 'distant water' fisheries, due to an apparent lack of sampling of smaller individuals (Section 2.2).

2.4 Reweighting of longline extraction and index fishery compositions

The size compositions were reweighted separately for each size metric (i.e., length or weight) using the following approach:

1. For a given fishery, size samples and aggregate catches (numbers) were aggregated to a strata resolution (i.e., a stratification of year-quarter, 10 x 20° cell and fishery).

2. Size samples for mixed fleet fisheries were then filtered for fleets with a minimum sample size per year-quarter and fishery, in an attempt to ensure that assessment fishery size compositions were only informed by data from fleets with sufficient sampling.

3. Size samples for mixed fleet fisheries were then filtered for fleets contributing a minimum proportion of the total catch for that year-quarter and fishery, to prevent samples from relatively minor fleets from influencing the assessment fishery size compositions.

4. The size samples were then filtered for strata with a minimum of samples, to attempt to reduce noise in size compositions due to low sample sizes. The total remaining samples per fishery and year-quarter are referred to as the 'original sample size' (OSS).

5. 'Strata weights' for extraction fisheries were then calculated using the proportion of catch over a time-window of $2k + 1$ quarters accounted for by each 10 x 20° cell

$$W_{i,t} = \frac{\sum_{\tau=t-k}^{t+k} C_{i,\tau}}{\sum_i \sum_{\tau=t-k}^{t+k} C_{i,\tau}}$$

   where $W_{i,t}$ and $C_{i,t}$ are the strata weight and catch (respectively) for 10 x 20° cell i and year-quarter t. Strata weights for index fisheries were equivalent but weighted by estimated relative abundance from the CPUE standardisation model by 10 x 20° cell and year-quarter, rather than catch. Strata weights ($W_{i,t}$) were calculated over a time-window of 11 quarters (i.e., $k = 5$) for both extraction and index fisheries.

6. Strata-level numbers by size class were then converted to proportions by size class.

7. Strata-level proportions by size class were then weighted by multiplying by the appropriate strata weight $W_{i,t}$.

8. The weighted proportions by size class were then summed across strata to obtain proportions by size class and year-quarter for the fishery.

9. The assessment model fishery-resolution proportions by size class were then raised to numbers by size class, by multiplying by the original sample size (OSS) for the fishery and year-quarter .

10. The assessment model fishery-resolution length compositions were then filtered for year-quarters where sampled strata accounted for a minimum proportion of the species-specific total catch (extraction fisheries) or relative abundance (index fisheries), i.e., filtering for year-quarters where

the sum of strata weights from sampled 10 x 20° cells exceeded a specified threshold. This limit is referred to as the 'minimum sampled weighting'.

11. Finally, the assessment model fishery-resolution length compositions were filtered for year-quarters with a minimum original sample size.

The strength of filters applied in the reweighting procedure are provided in Section 2.7.

For striped marlin, the temporal resolution of strata for index fisheries was year rather than year-quarter, to match both the temporal resolution of estimated relative abundance from the standardisation models used to generate the CPUE indices.

This approach implicitly scales the reweighted frequencies at a year-quarter and fishery resolution by the proportion of catch (extraction fisheries) or relative abundance (index fisheries) from 10 x 20° cells with size samples. For example, if sampled 10 x 20° cells accounted for 75% of the total catch for an extraction fishery and year-quarter, then the input sample size (ISS; see Section 2.5) would be equal to 75% of the original sample size (OSS) for that year-quarter.

2.5 Input sample sizes (ISS) for the assessment models

As described above, the number of samples per fishery and year-quarter after the initial filtering steps (e.g., step 4 in Section 2.4) is referred to as the 'original sample size' (OSS). We refer to the unit of frequencies of the reweighted size compositions as the 'input sample size' (ISS). The input sample sizes are equal to the original sample size multiplied by the proportion of the total catch (extraction fisheries) or abundance (index fisheries) from strata with size samples. For striped marlin, the input sample sizes were also further reduced by 50% for fisheries where samples were used for both extraction and index fisheries size compositions. This posthoc reduction was not applied to the swordfish compositions, due to differences in the approaches to data weighting that were used in the respective assessments. We note that the input sample sizes may be further adjusted as part of the model fitting procedure.

2.6 Compositions for potential PICT index fisheries

Compositional inputs were prepared for a range of options for a PICT index fishery in region 2 of the swordfish assessment, to match the preparation of CPUE indices in Neubauer et al. (2025). These included: 'Idx.PICT.2' – length samples from New Caledonia (NC), Fiji (FJ), Tonga (TO) and French Polynesia (PF); 'Idx.NCFT.2' – length samples from New Caledonia, Fiji and Tonga; and, 'Idx.PF.2' – length samples from French Polynesia only. The compositional inputs were generated from observer data only, with SPLL length (and weight data) excluded (see Section 2.2).

2.7 Data filtering strengths

The strength of the different data filtering rules represents a compromise between attempting to remove artefacts of sampling in compositional inputs to the assessment model, whilst also ensuring that there are sufficient compositional inputs to obtain robust estimates of selectivities. Filtering strengths were selected separately for each species and fishery type (i.e., extraction fisheries, and the different index fisheries), to attempt to get the most robust estimates of compositions across all assessment model fisheries within that fishery type. The data filtering rules that were applied are described separately for each species below. Weaker filtering was typically applied to striped marlin compared to swordfish, reflecting the more limited numbers of available size samples.

Reweighted size compositions for swordfish extraction fisheries were generated with the following filters: a minimum of 30 samples per strata; a minimum sampled weighting of 0.3 (i.e., sampled strata must account for a minimum of 30% of the catch for a fishery and year-quarter); and, a minimum original sample size of 50 for a fishery and year-quarter. However, for fisheries in the '1S' and '2S', no filtering was applied to the size compositions due to the relatively large fish in these regions, combined with the relatively limited numbers of size samples. The treatment of compositional inputs for these fisheries is described in the Day et al. (2025). Reweighted size compositions for the EU swordfish index were generated with the following filters: a minimum of 30 samples per strata; a minimum sampled weighting of 0.1 (i.e., sampled strata must account for a minimum of 10% of the estimated relative abundance for a year-quarter); and, a minimum original sample size of 500 for a fishery and year-quarter. Reweighted size compositions for the PICT index fishery options were generated with the following filters: a minimum of 30 samples per strata; a minimum sampled weighting of 0.3 (i.e., sampled strata must account for a minimum of 30% of the estimated relative abundance for a year-quarter); and, a minimum original sample size of 50 for a fishery and year-quarter.

Reweighted length compositions for striped marlin extraction fisheries were generated with the following filters: samples from fleets contributing at least 5% of the catch for a fishery and year-quarter; a minimum of 10 samples per strata; a minimum sampled weighting of 0.3 (i.e., sampled strata must account for a minimum of 30% of the catch for a fishery and year-quarter); and, a minimum original sample size of 30 for a fishery and year-quarter. Reweighted weight compositions for striped marlin extraction fisheries were generated with the following filters: a minimum of 30 samples per strata; a minimum sampled weighting of 0.3 (i.e., sampled strata must account for a minimum of 30% of the catch for a fishery and year-quarter); and, a minimum original sample size of 150 for a fishery and year-quarter. Reweighted size compositions for the JP-TW index fishery were generated with the following filters: a minimum of 10 samples per strata; a minimum sampled weighting of 0.1 (i.e., sampled strata must account for a minimum of 10% of the relative abundance for the year); and, a minimum original sample size of 200 for a fishery and year-quarter.

3 Results and Discussion

Reweighted size compositions and their associated input sample sizes are provided in Appendices specific to each species, fishery type (i.e., extraction and index fisheries) and unit of size:

- Length compositions for swordfish extraction fisheries: Appendix A, Figures A.1 to A.19.

- Weight compositions for swordfish extraction fisheries: Appendix B, Figures B.1 to B.5.
- Length compositions for swordfish index fisheries: Appendix C, Figures C.1 to C.3.
- Length compositions for striped marlin extraction fisheries: Appendix D, Figures D.1 to D.9.
- Weight compositions for striped marlin extraction fisheries: Appendix E, Figures E.1 to E.6.
- Length compositions for striped marlin index fisheries: Appendix F, Figures F.1 & F.2.
- Weight compositions for striped marlin index fisheries: Appendix G, Figures G.1 & G.2.

The number of available size samples varies between fisheries for both swordfish and striped marlin. However, the numbers of samples were typically low for both species in comparison to those available for tuna species in the Western and Central Pacific Ocean, with fewer than 300 samples for many fishery and time-step combinations. These low sample sizes reflect the relatively limited catches of these species, which are typically incidentally caught in fisheries in the region. This suggests that the estimates of size compositions for both extraction and index fisheries may be imprecise. There was appreciable levels of variability in reweighted compositions for a range of fisheries that may reflect noise, rather than temporal variation in size compositions, e.g., in length compositions for the '03.DW.1S' swordfish extraction fishery (Figure A.4). For swordfish, there were apparent pulses of small fish in some extraction fishery compositions, most clearly for fisheries in subarea 2N (Figures A.7 & A.15). These pulses were detected in size samples from a range of data sources, including a variety of observer programmes, which suggests that they are not an artefact of sampling. There were indications of cohort progression for some fisheries, often for those with weight samples and relatively high sample sizes, e.g., for the '05.AU.1C' (Figure B.3) and '13.NZ.2C' (Figure B.4) swordfish extraction fisheries. There was limited evidence of clear temporal trends in size compositions, with the exception of the declining trend in weights for the '07.LL.AU.3' striped marlin extraction fishery (Figure E.6).

It is difficult to objectively assess the quality of size composition inputs, e.g., when comparing different filtering strengths or approaches, as there is limited a priori information on what constitutes plausible levels of variability, e.g. temporal variation. The approach implemented here is an attempt to remove apparent noise in size compositions through the application of consistent data filtering rules. If apparent noise at a fishery level can be removed by excluding size compositions from fleets or strata with limited sampling, then it suggests that the observed patterns in compositions were an artefact of sampling. Additionally, if temporal variation is removed when increasing the 'minimum sampled weighting', it suggests that the apparent variation reflected unrepresentative sampling. However, it is relatively time-consuming to construct various options for size composition inputs and then assess the sensitivity of the assessment models to the different approaches, and the comparisons are necessarily subjective. Phase 1 of the recent review of the size composition holdings of the Pacific Community has identified data sources that should be excluded, e.g., based on concerns around sampling approaches (Hamer et al., 2025), and has proven to be a valuable objective complement to the more subjective filtering approaches that are typically implemented in assessments of tuna and billfish species in the Western and Central Pacific Ocean.

The reweighting of size compositions has historically been complicated by unrepresentative coverage of size samples, temporal changes in the coverage of size samples between fleets within assessment model fisheries, as well as temporal changes in their contributions to catches. This is problematic in the sense that temporal changes in sampling coverage can result in apparent shifts in size compositions within an assessment fishery that are driven by sampling, rather than changes in the size composition of catches and the underlying population. More fundamentally, it also creates difficulties in determining the most appropriate structuring of fisheries in the assessment model, e.g., separating spatial variation from variability between fleets, identifying fleets with similar size compositions, etc. These issues are particularly acute for species like swordfish and striped marlin, which are typically incidentally caught in fisheries in the region. In the context of the current overall approach to the reweighting of size compositions, filtering rules have been implemented to attempt to prevent temporal changes in sampling coverage, and noise in high-resolution compositional data, from propagating through to assessment model inputs.

Here, we tested three new filters relative to those used for the 2024 southwest Pacific striped marlin assessment (Castillo-Jordán et al., 2024). Assessment fishery-level compositions were filtered for year-quarters with a minimum original sample size. This filter is intended to remove compositions with insufficient samples to inform a robust estimate of the size compositions, and so mitigate against the propagation of noise through to assessment model inputs. This filter was motivated by the apparent noise in size compositions used in the 2024 striped marlin assessment, which was sometimes associated with year-quarters with limited samples. Gerritsen and McGrath (2007) suggest a minimum of 10 times the number of size classes, which would equate to a minimum of 300 to 1 200 samples for the size classes used here. The strength of filtering applied here was substantially lower than this, in order to retain sufficient compositional inputs to inform the assessment model, but was still effective in reducing (if not removing) apparent noise across a range of fisheries.

Two approaches to filtering were tested for application to mixed fleet fisheries, motivated in part by apparent temporal variation in size compositions for mixed fleet fisheries in the 2024 striped marlin assessment. The first approach was to filter for samples from fleets contributing a minimum proportion of catch for a fishery and year-quarter. This aims to prevent samples from relatively minor fleets from having an influence on assessment fishery resolution compositions, when using spatial stratification in the reweighting procedure. This filter did reduce apparent noise in compositional inputs for the striped marlin 'LL.ALL.1' fishery, which includes a mix of fleets with temporal variation both in reported catches by fleet and their sampling coverage, but otherwise had relatively limited influence. Initial testing indicated that the swordfish compositions were not materially improved with this filter, and so it was not implemented when reweighting size compositions for the assessment model. The second approach for mixed fleet fisheries was filtering for a minimum number of samples per fleet and year-quarter, aimed at reducing the propagation of noise by removing compositional data from poorly sampled fleets. This filter did not appreciably improve compositional inputs for either the striped marlin or swordfish assessments and so was not implemented when generating inputs for the assessment models. However, this filter should be considered when reweighting compositional inputs for future assessments of tuna and billfish in the Western and Central Pacific Ocean.

The existing procedures used to reweight size compositions provide a means of accounting for imbalanced sampling across fleets and regions. However, the reweighting procedure can not infer size compositions for strata with no available samples. There are numerous cases where there is no coverage of key fleets with available size samples for some years, particularly for longline fisheries. This can result in temporal variation in index and extraction fishery compositions which likely reflects changes in sampling availability and intensity between fleets, rather than changes in the composition of catches or the underlying population. Spatial-temporal modelling approaches provide a means of inferring size compositions for strata missing samples (Maunder et al., 2020). Exploring this approach for WCPFC tuna and billfish assessments has been recommended as part of phase 2 work under WCPFC project 127 (Hamer et al., 2025).

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Tables

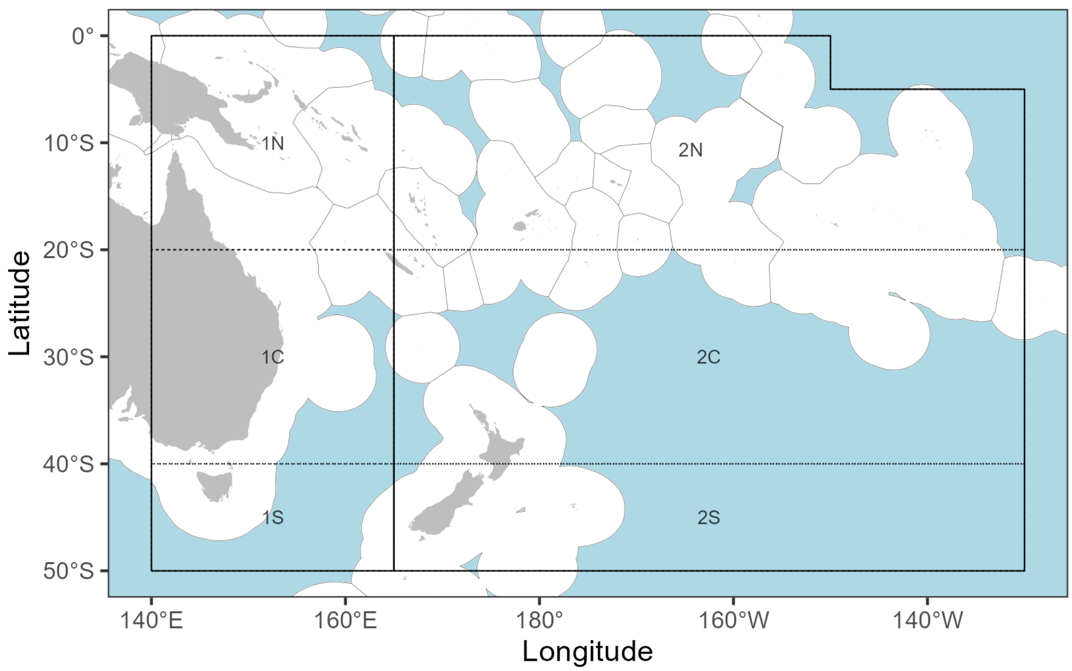
Table 1: Extraction and index fisheries in the 2025 southwest Pacific swordfish assessment model (Day et al., 2025), and whether their size compositions are reweighted. '-P' denotes size compositions using port-sampling data (only). 'Idx' denotes an index fishery. Nationality: DW = distant water fishing nations (Japan, Korea, Taiwan, China, EU and Vanuatu); PICT = Pacific Island Countries and Territories; AU = Australia; EU = European Union; FJ = Fiji; NC = New Caledonia; NZ = New Zealand; PF = French Polynesia; TO = Tonga. Gear: LL = longline.

Fishery ID	Nationality	Gear	Subregion	Reweighted compositions
01.DW.1N	DWFN	LL	1N	TRUE
02.DW.1C	DWFN	LL	1C	TRUE
03.DW.1S	DWFN	LL	1S	TRUE
04.AU.1N	AU	LL	1N	TRUE
05.AU.1C	AU	LL	1C	TRUE
06.AU.1S	AU	LL	1S	TRUE
07.EU.1C	EU	LL	1C	TRUE
08.PICT.1N	PICT	LL	1N	TRUE
09.PICT.1C	PICT	LL	1C	TRUE
10.DW.2N	DWFN	LL	2N	TRUE
11.DW.2C	DWFN	LL	2C	TRUE
12.DW.2S	DWFN	LL	2S	TRUE
13.NZ.2C	NZ	LL	2C	TRUE
14.NZ.2S	NZ	LL	2S	TRUE
15.EU.2N	EU	LL	2N	TRUE
16.EU.2C	EU	LL	2C	TRUE
17.EU.2S	EU	LL	2S	TRUE
18.PICT.2N	PICT	LL	2N	TRUE
19.PICT.2C	PICT	LL	2C	TRUE
20.Idx.AU.1	AU	LL	1	FALSE
21.Idx.NZ.2	NZ	LL	2	FALSE
22.Idx.EU.2	EU	LL	2	TRUE
23.Idx.PICT.2	PICT	LL	2	TRUE
24.Idx.NCFT.2	NCFJTO	LL	2	TRUE
25.Idx.PF.2	PF	LL	2	TRUE
31.PICT-P.1N	PICT	LL	1N	TRUE
32.PICT-P.1C	PICT	LL	1C	TRUE
33.PICT-P.2N	PICT	LL	2N	TRUE
34.PICT-P.2C	PICT	LL	2C	TRUE

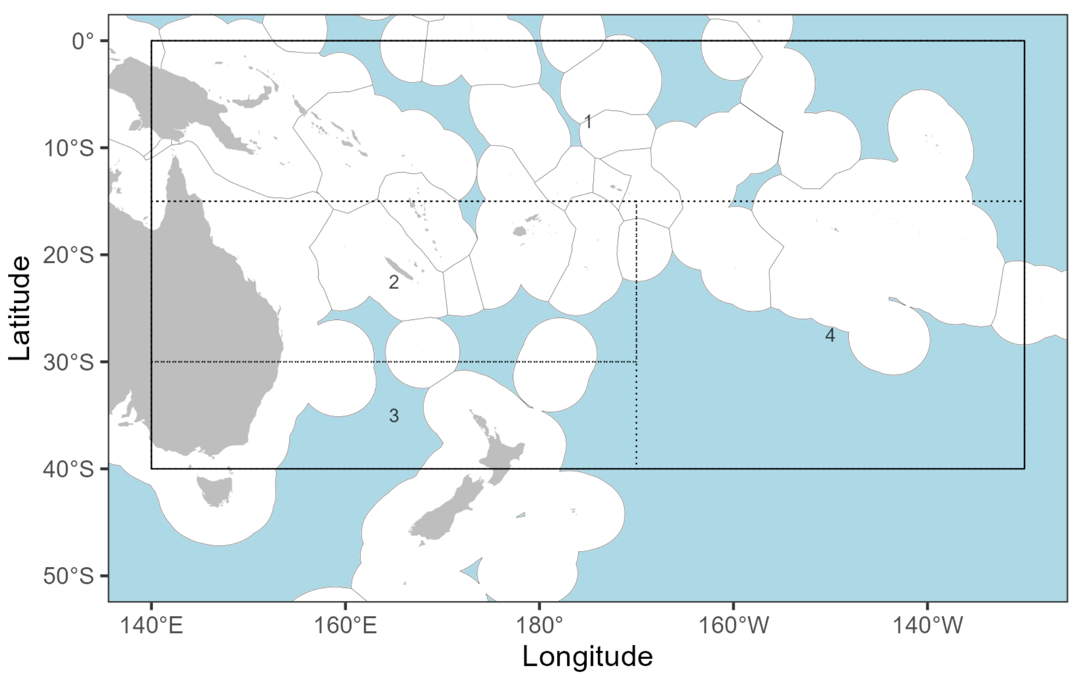
Table 2: Extraction and index fisheries in the 2025 southwest Pacific striped marlin assessment model (Castillo-Jordán et al., 2025), and whether their size compositions are reweighted. 'Idx' denotes an index fishery. Nationality: AU = Australia; FJ = Fiji; JP = Japan; NC = New Caledonia; NZ = New Zealand; PF = French Polynesia; TW = Taiwan. Gear: LL = longline, REC = Recreational. The JP longline extraction fishery in region 2 ('02.LL.JP.02') was split into two periods in the assessment, an early ('15.LL.JP.2.early' – 1952 to 1978) and late ('02.LL.JP.2.late' – 1979 to 2022), but is treated in this report as a single fleet.

Fishery ID	Nationality	Gear	Subregion	Reweighted compositions
01.LL.JP.1	JP	LL	1	TRUE
02.LL.JP.2	JP	LL	2	TRUE
03.LL.JP.3	JP	LL	3	TRUE
04.LL.JP.4	JP	LL	4	TRUE
05.LL.TW.4	TW	LL	4	TRUE
06.LL.AU.2	AU	LL	2	TRUE
07.LL.AU.3	AU	LL	3	TRUE
08.LL.NZ.3	NZ	LL	3	TRUE
09.REC.AU.3	AU	REC	3	FALSE
10.REC.NZ.3	NZ	REC	3	FALSE
11.LL.ALL.1	DWFN/PICT	LL	1	TRUE
12.LL.ALL.2	DWFN/PICT	LL	2	TRUE
13.LL.ALL.3	DWFN/PICT	LL	3	TRUE
14.LL.ALL.4	DWFN/PICT	LL	4	TRUE
16.LL.NC.2	NC	LL	2	TRUE
17.LL.PF.4	PF	LL	4	TRUE
18.Idx.JPTW.1-4	JP & TW	LL	1–4	TRUE
19.Idx.NZ.3	NZ	LL	3	FALSE
20.Idx.AU.2-3	AU	LL	2 & 3	FALSE
21.Idx.NCFJTO.2	NC, FJ & TO	LL	2	FALSE
22.Idx.PF.4	PF	LL	4	FALSE

Figures



(a) Swordfish



(b) Striped marlin

Figure 1: The region structures used to define fisheries for (a) swordfish and (b) striped marlin. For swordfish there were two model regions, each with three sub-regions to implement a fleets-as-areas approach. For striped marlin, there was a single model region, with four sub-regions to implement a fleets-as-areas approach.

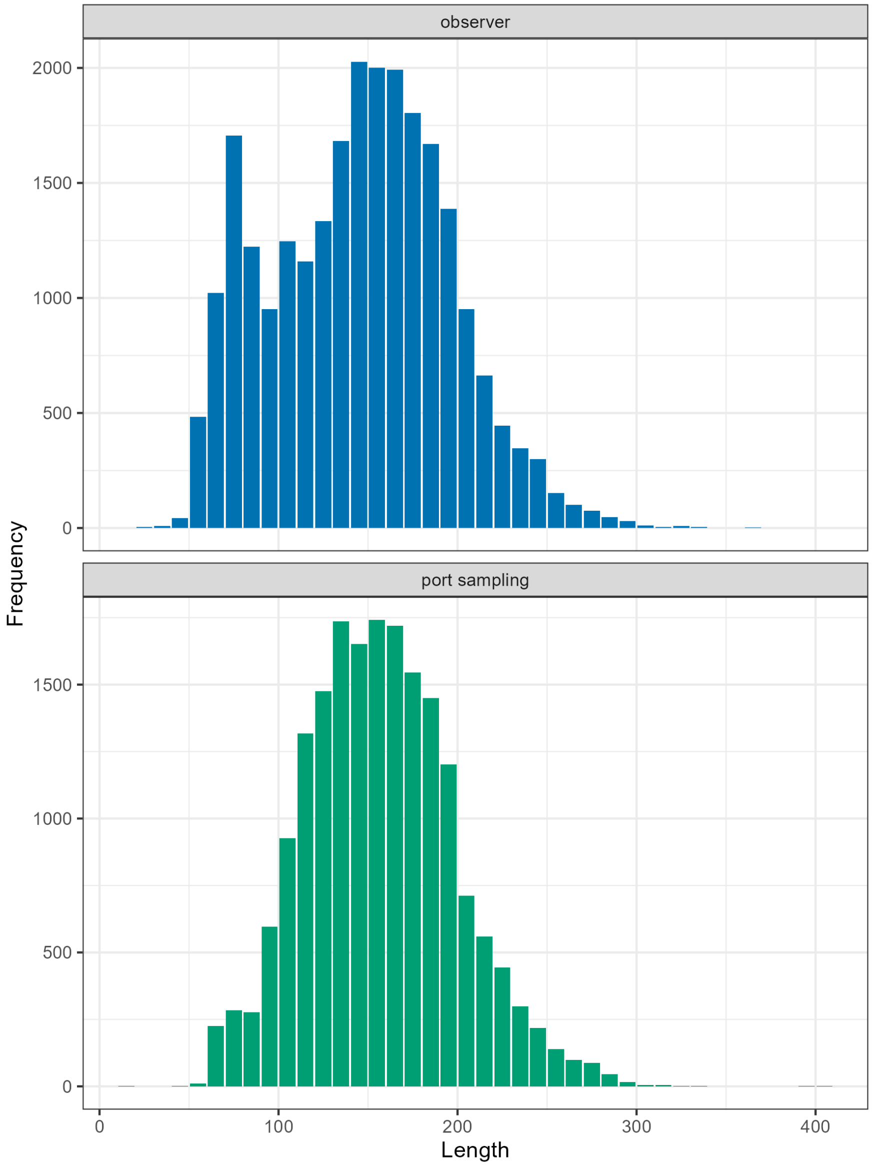


Figure 2: Aggregated length frequencies of swordfish for PICT fleets using observer data (top panel) and port sampling data (bottom panel).

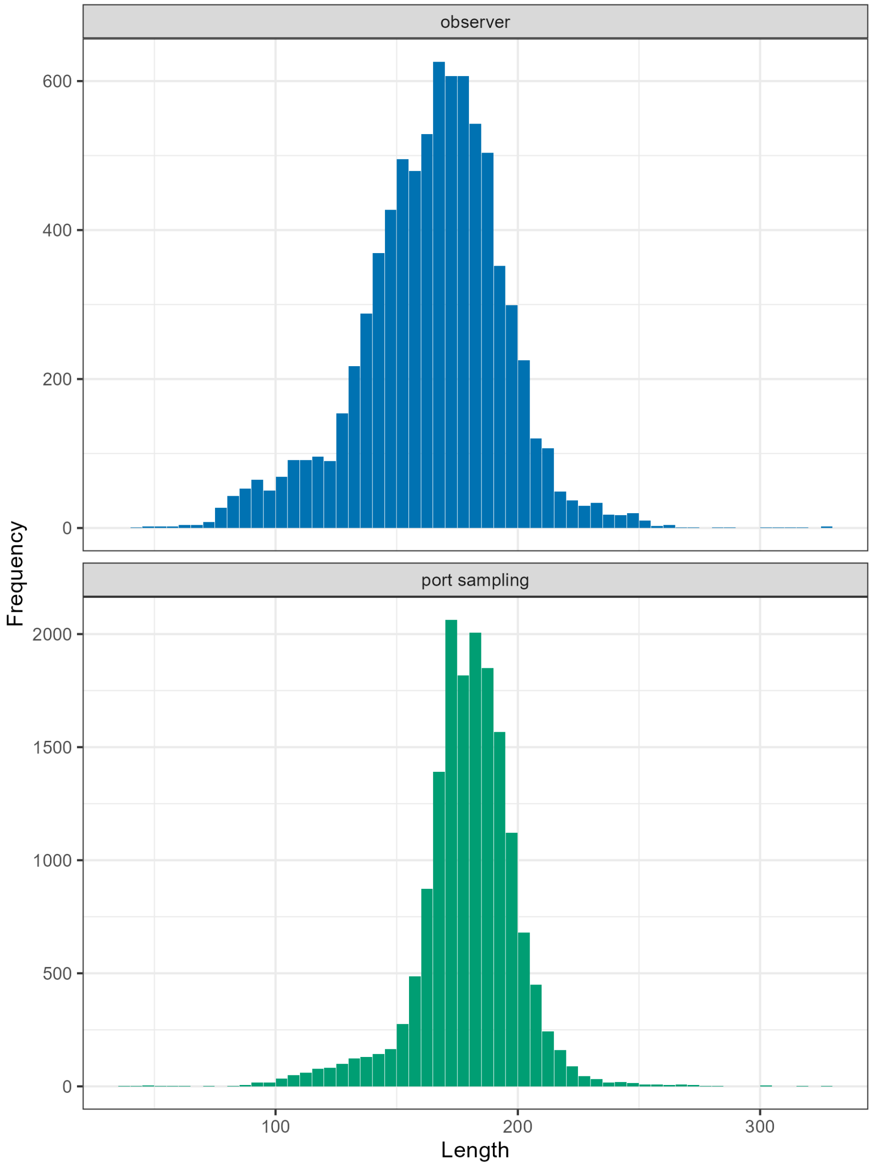


Figure 3: Aggregated length frequencies of striped marlin for PICT fleets using observer data (top panel) and port sampling data (bottom panel).

Appendices

A Swordfish extraction fishery length compositions

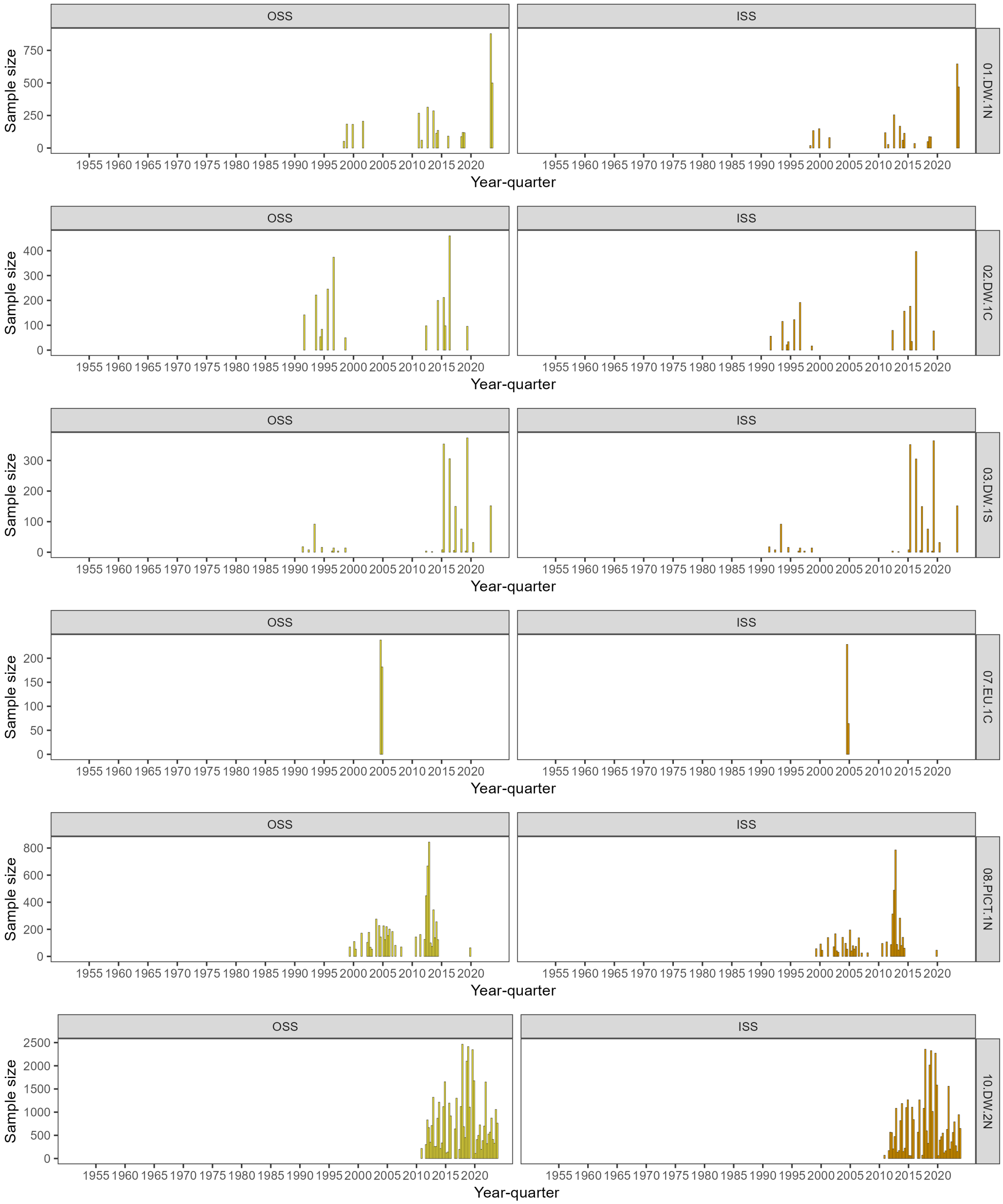


Figure A.1: Original sample sizes (OSS) and input sample sizes (ISS) for longline extraction fishery length compositions.

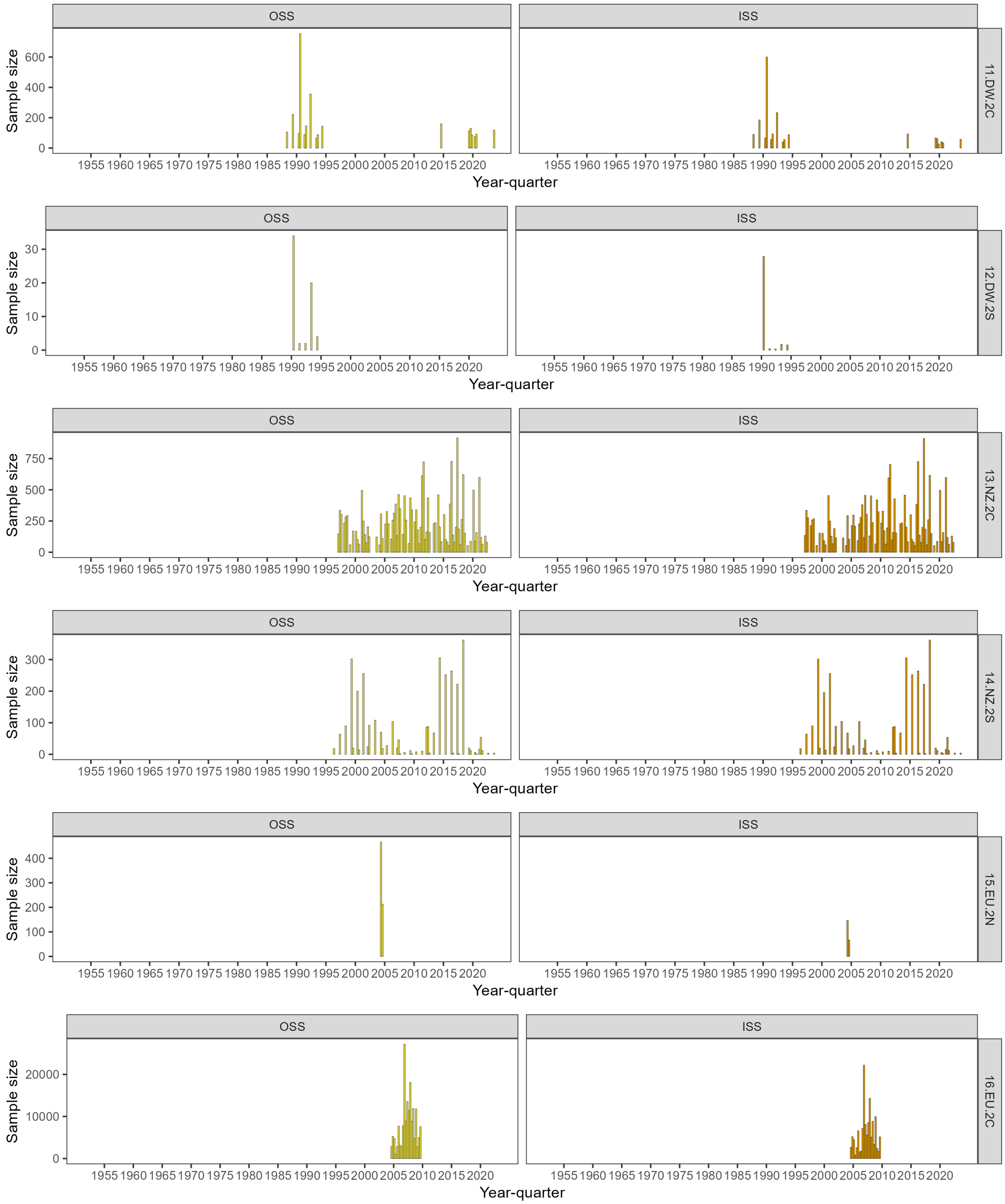


Figure A.1: Original sample sizes (OSS) and input sample sizes (ISS) for swordfish longline extraction fishery length compositions (cont.).

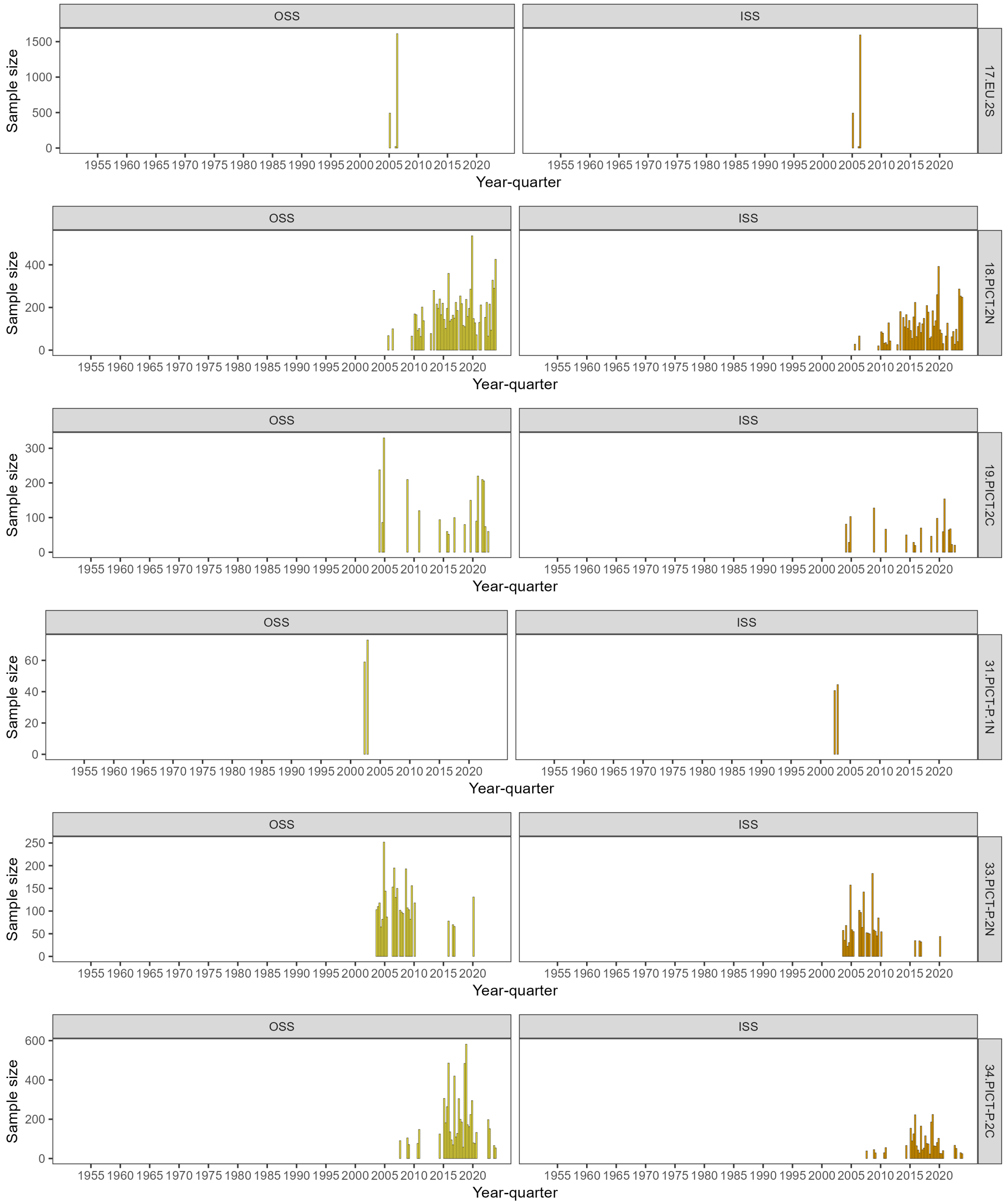


Figure A.1: Original sample sizes (OSS) and input sample sizes (ISS) for swordfish longline extraction fishery length compositions (cont.).

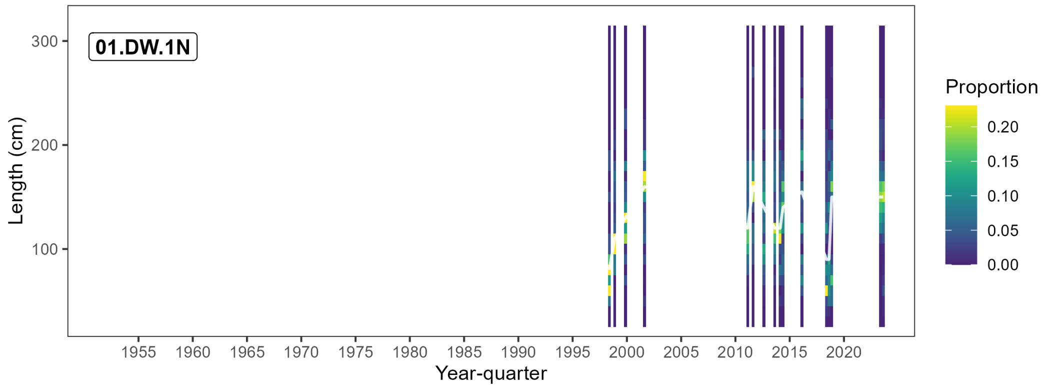


Figure A.2: Reweighted length compositions of swordfish for the extraction fishery 01.DW.1N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

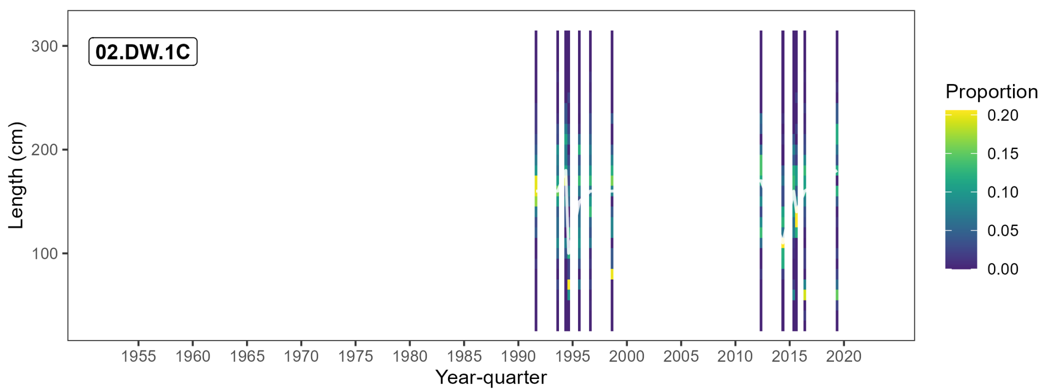


Figure A.3: Reweighted length compositions of swordfish for the extraction fishery 02.DW.1C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

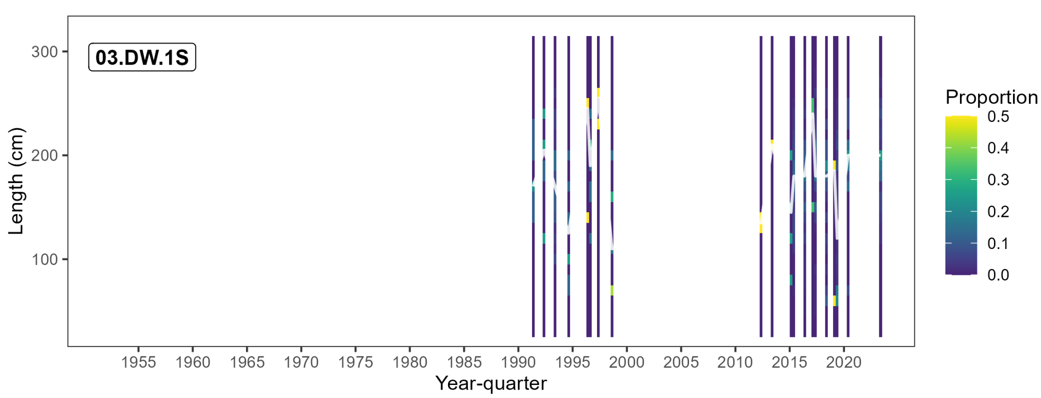


Figure A.4: Reweighted length compositions of swordfish for the extraction fishery 03.DW.1S . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

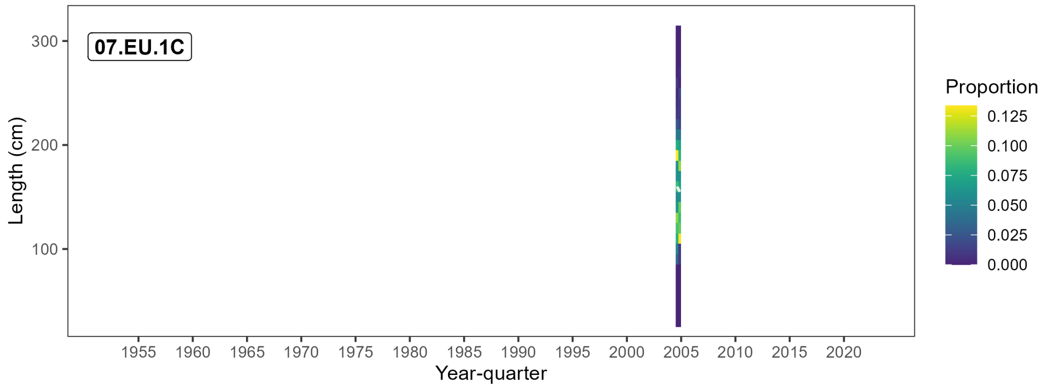


Figure A.5: Reweighted length compositions of swordfish for the extraction fishery 07.EU.1C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

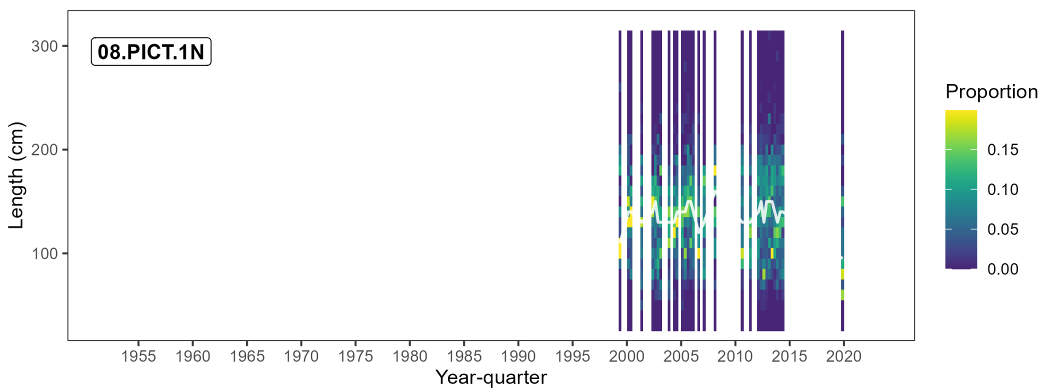


Figure A.6: Reweighted length compositions of swordfish for the extraction fishery 08.PICT.1N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

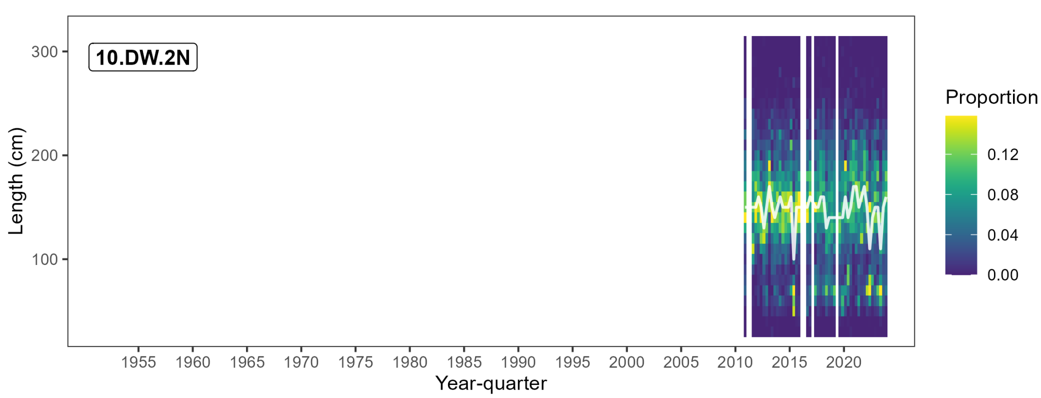


Figure A.7: Reweighted length compositions of swordfish for the extraction fishery 10.DW.2N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

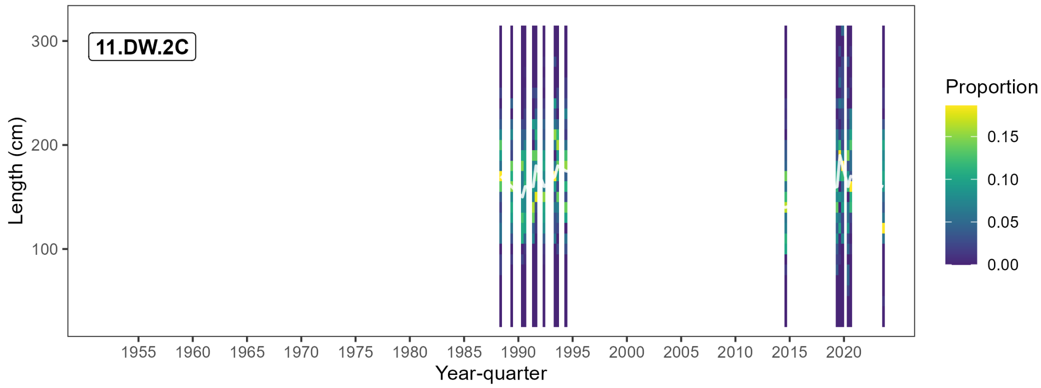


Figure A.8: Reweighted length compositions of swordfish for the extraction fishery 11.DW.2C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

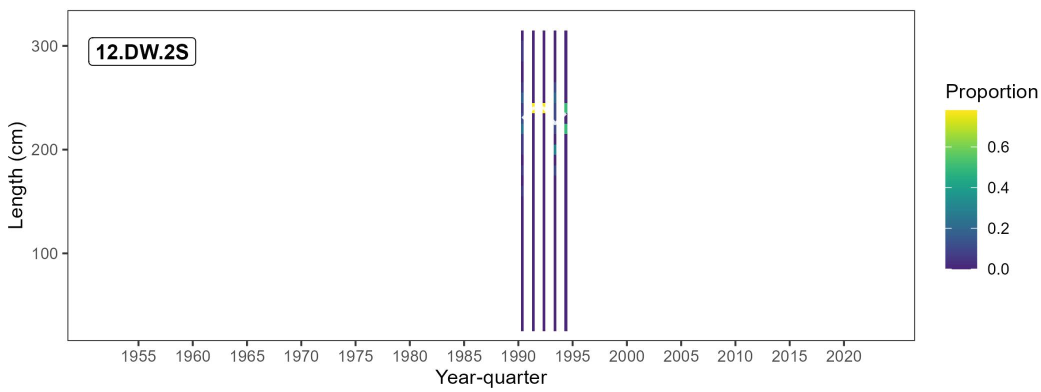


Figure A.9: Reweighted length compositions of swordfish for the extraction fishery 12.DW.2S . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

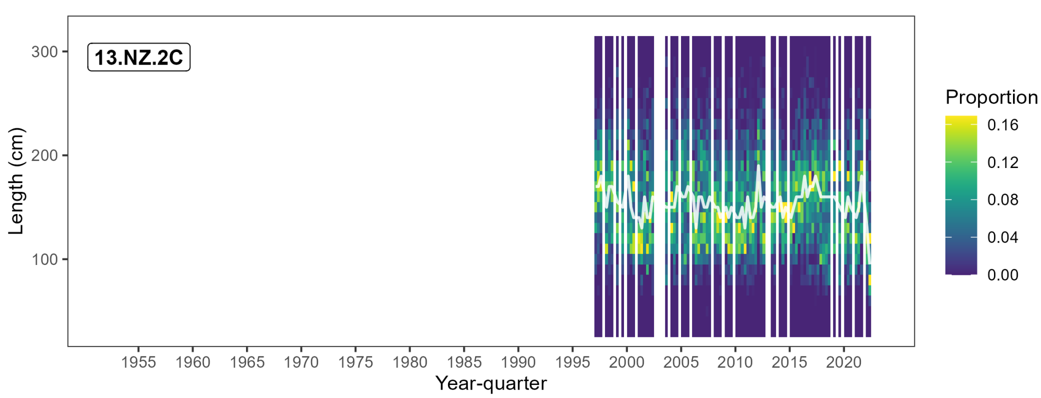


Figure A.10: Reweighted length compositions of swordfish for the extraction fishery 13.NZ.2C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

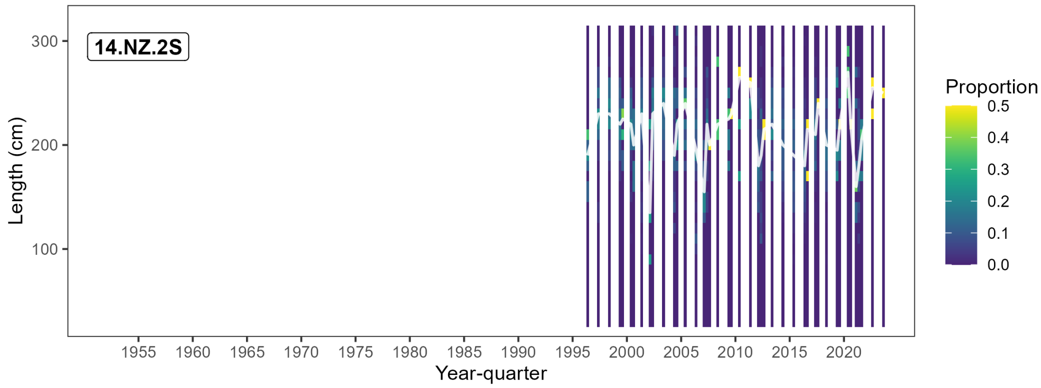


Figure A.11: Reweighted length compositions of swordfish for the extraction fishery 14.NZ.2S . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

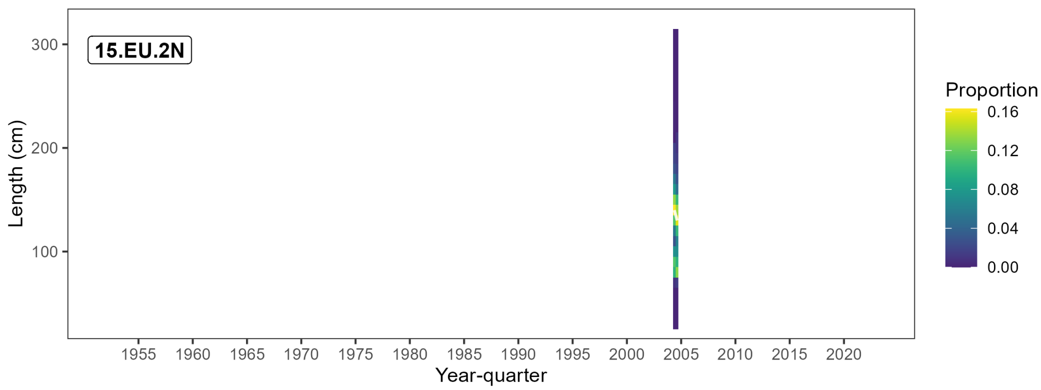


Figure A.12: Reweighted length compositions of swordfish for the extraction fishery 15.EU.2N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

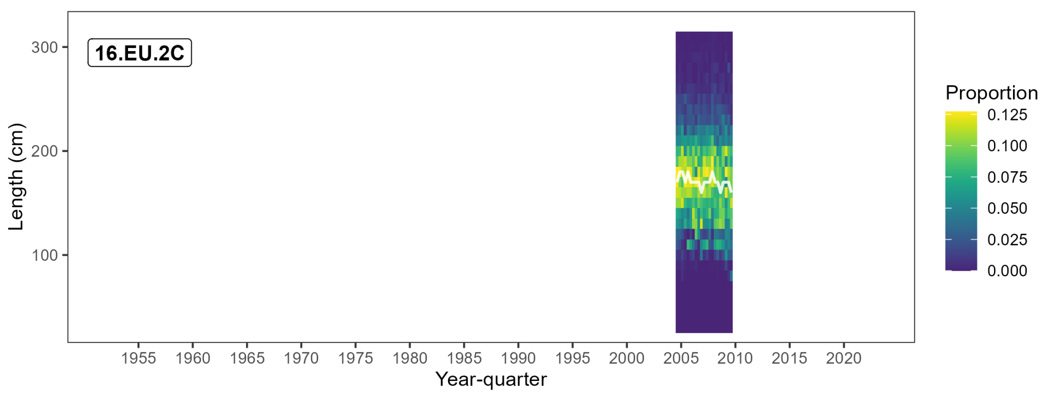


Figure A.13: Reweighted length compositions of swordfish for the extraction fishery 16.EU.2C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

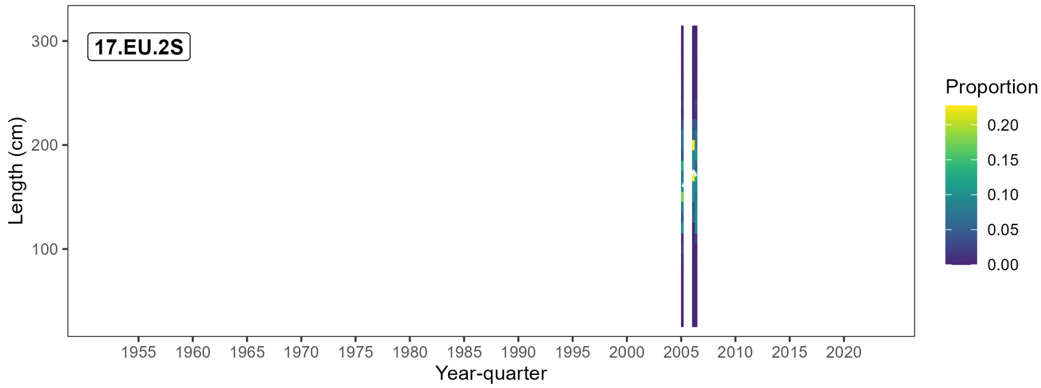


Figure A.14: Reweighted length compositions of swordfish for the extraction fishery 17.EU.2S . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

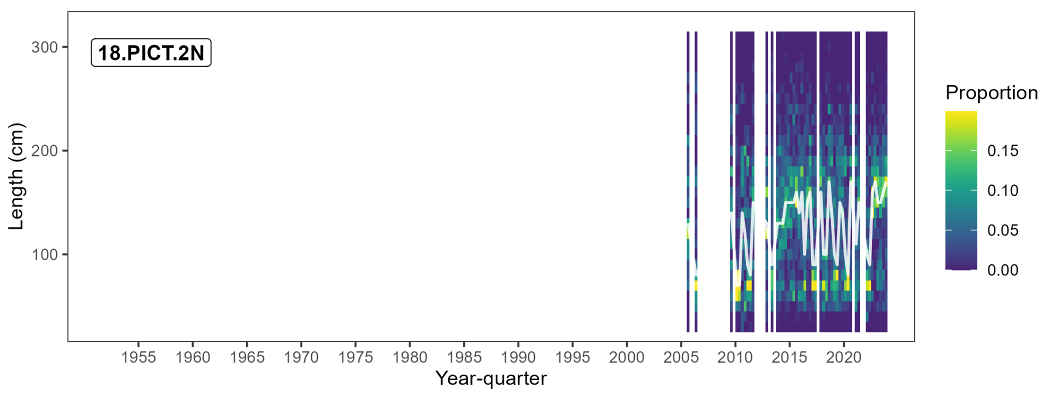


Figure A.15: Reweighted length compositions of swordfish for the extraction fishery 18.PICT.2N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

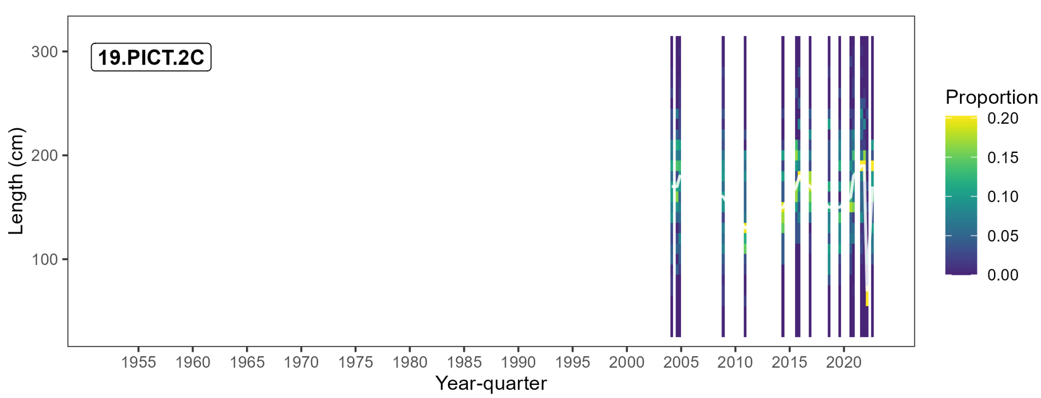


Figure A.16: Reweighted length compositions of swordfish for the extraction fishery 19.PICT.2C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

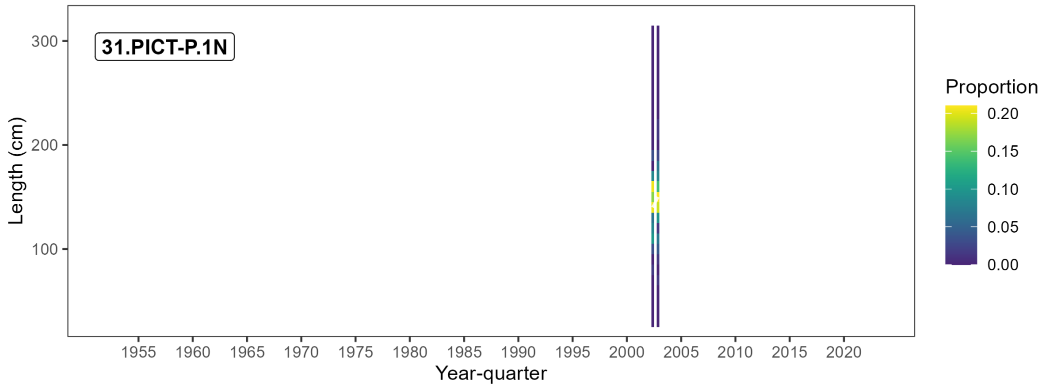


Figure A.17: Reweighted length compositions of swordfish for the extraction fishery 31.PICT-P.1N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

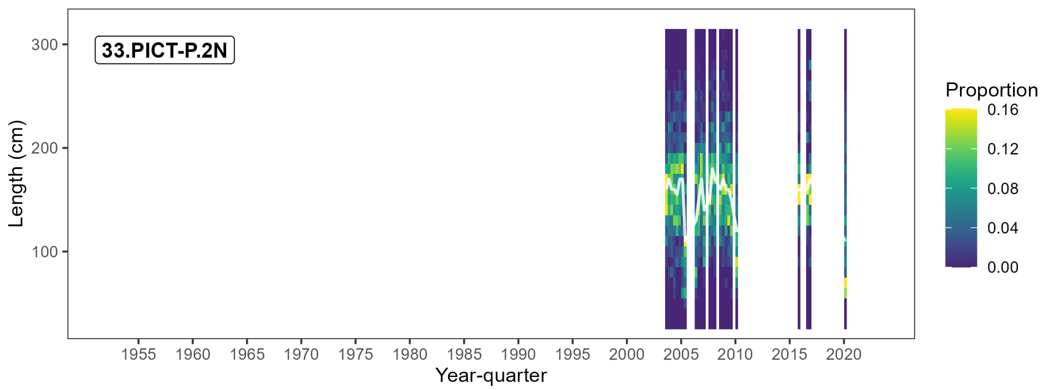


Figure A.18: Reweighted length compositions of swordfish for the extraction fishery 33.PICT-P.2N . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

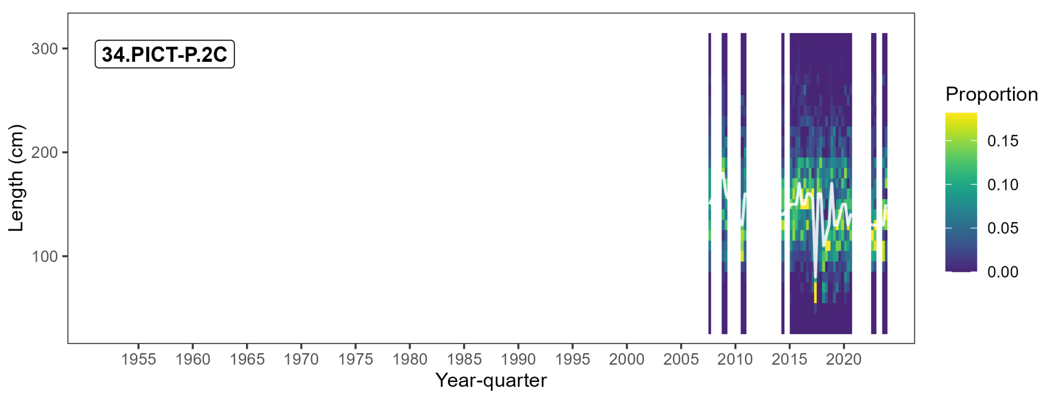


Figure A.19: Reweighted length compositions of swordfish for the extraction fishery 34.PICT-P.2C . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

B Swordfish extraction fishery weight compositions

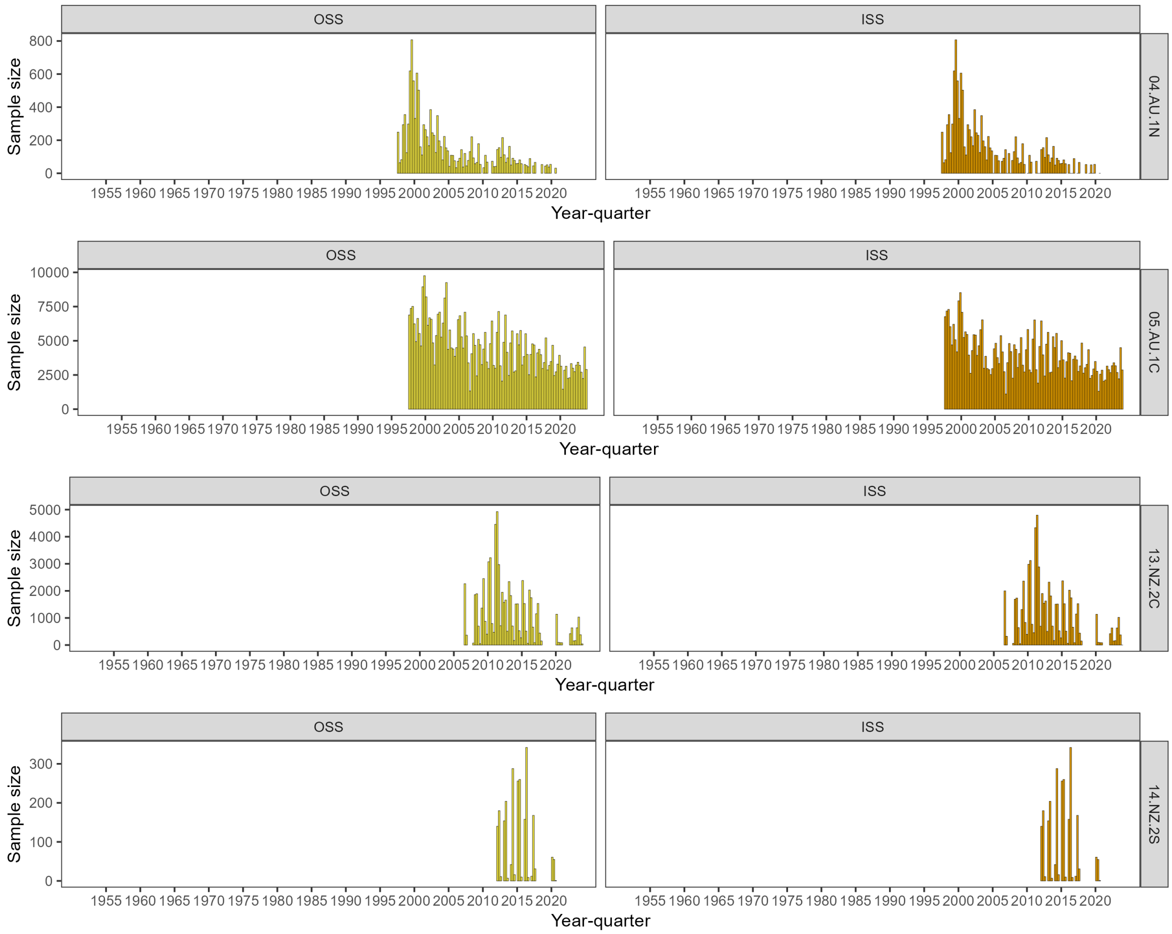


Figure B.1: Original sample sizes (OSS) and input sample sizes (ISS) for swordfish longline extraction fishery weight compositions.

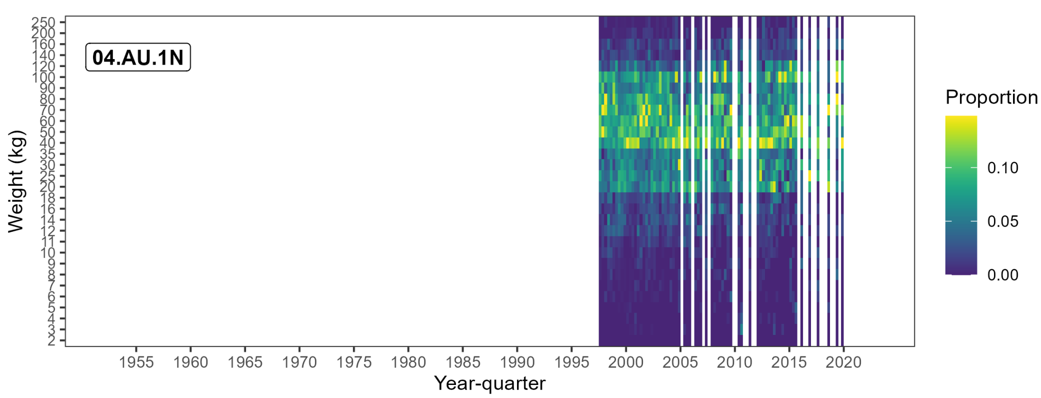


Figure B.2: Reweighted weight compositions of swordfish for the extraction fishery 04.AU.1N . The colour of each cell gives the proportions by size class for the year-quarter.

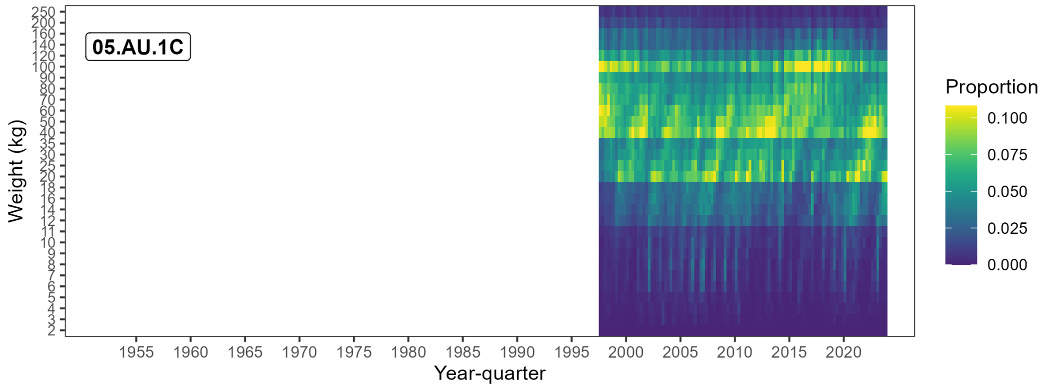


Figure B.3: Reweighted weight compositions of swordfish for the extraction fishery 05.AU.1C . The colour of each cell gives the proportions by size class for the year-quarter.

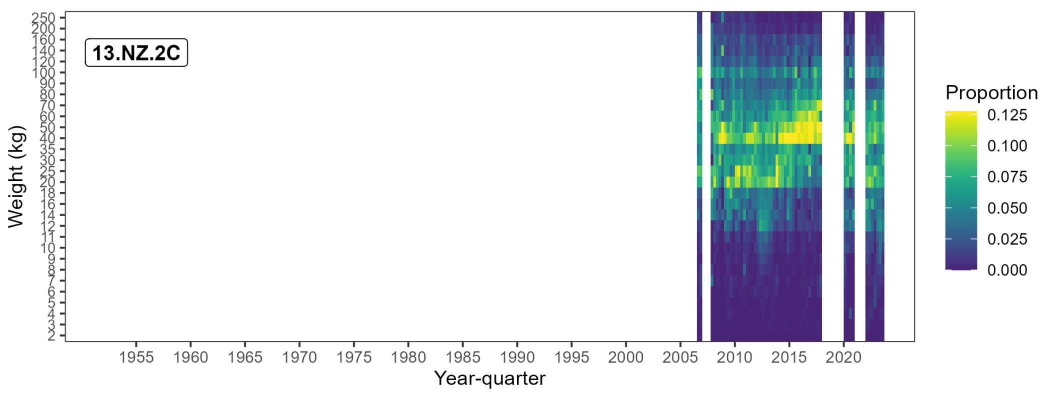


Figure B.4: Reweighted weight compositions of swordfish for the extraction fishery 13.NZ.2C . The colour of each cell gives the proportions by size class for the year-quarter.

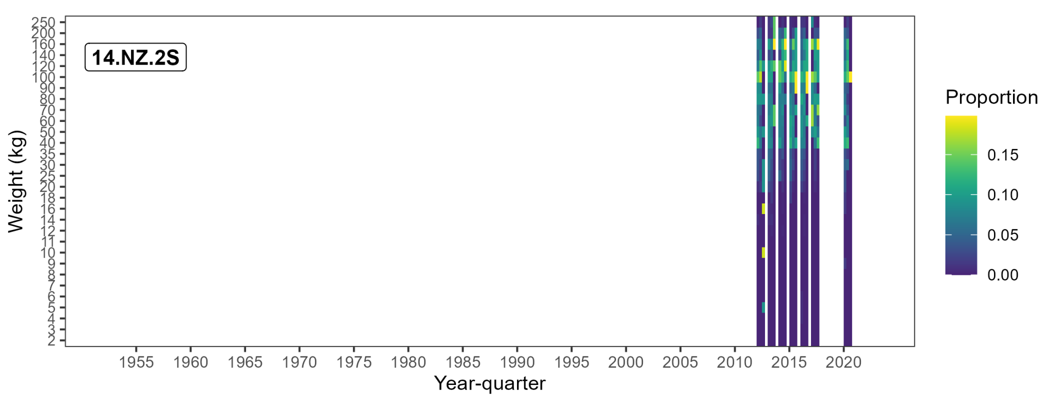
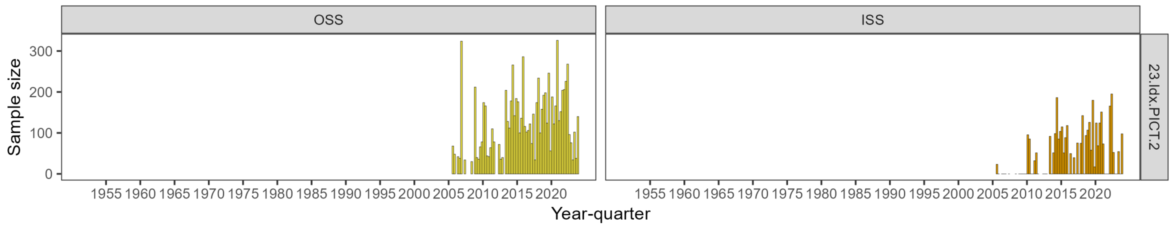


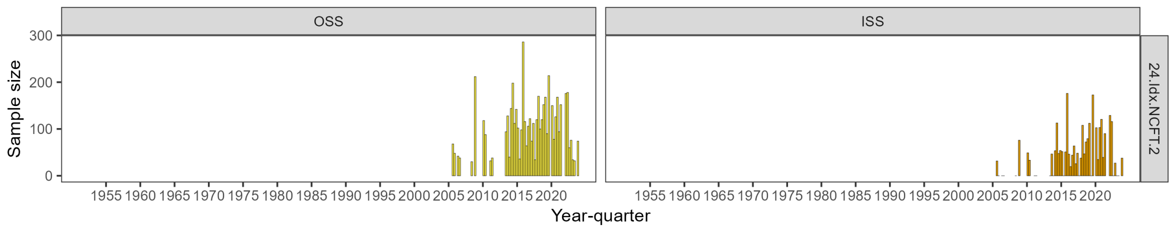
Figure B.5: Reweighted weight compositions of swordfish for the extraction fishery 14.NZ.2S . The colour of each cell gives the proportions by size class for the year-quarter.

C Swordfish index fishery length compositions

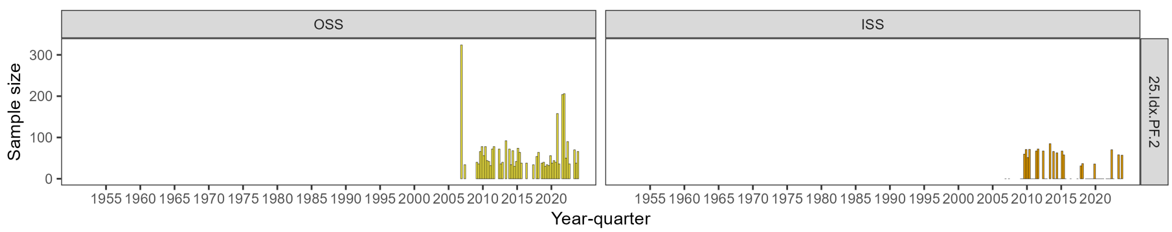
(a) PICT index (NC, FJ, TO & PF)



(b) PICT index (NC, FJ & TO)



(c) PICT index (PF)



(d) EU index

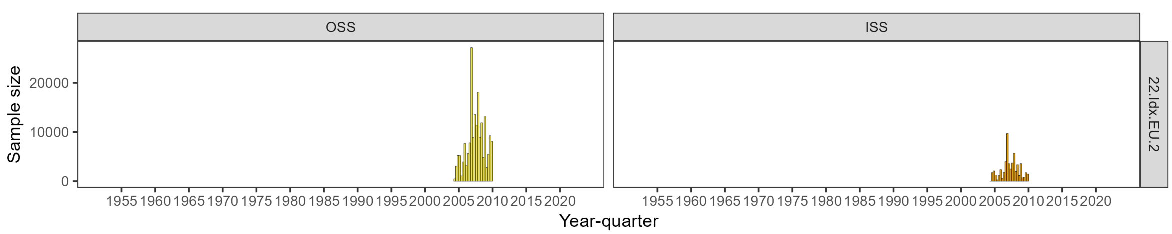
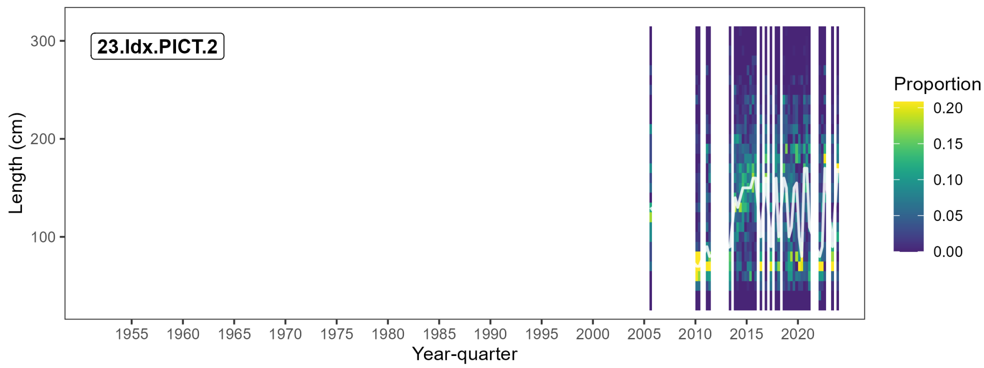
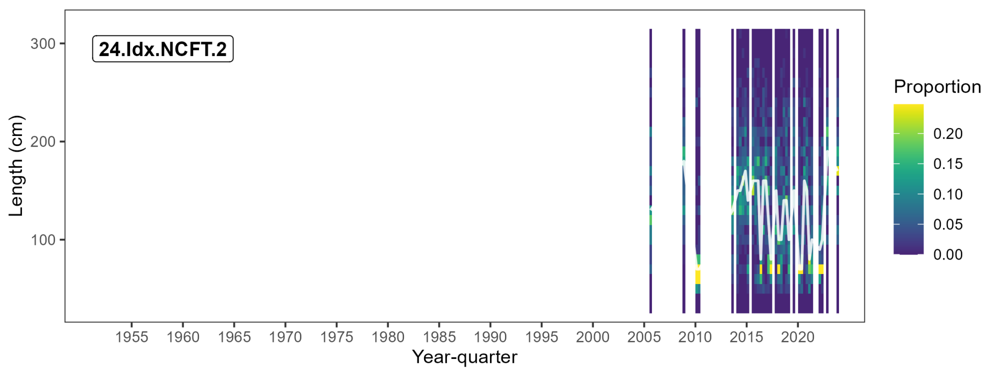


Figure C.1: Original sample sizes (OSS) and input sample sizes (ISS) for swordfish longline index fishery length compositions.

(a) PICT index (NC, FJ, TO & PF)



(b) PICT index (NC, FJ & TO)



(c) PICT index (PF)

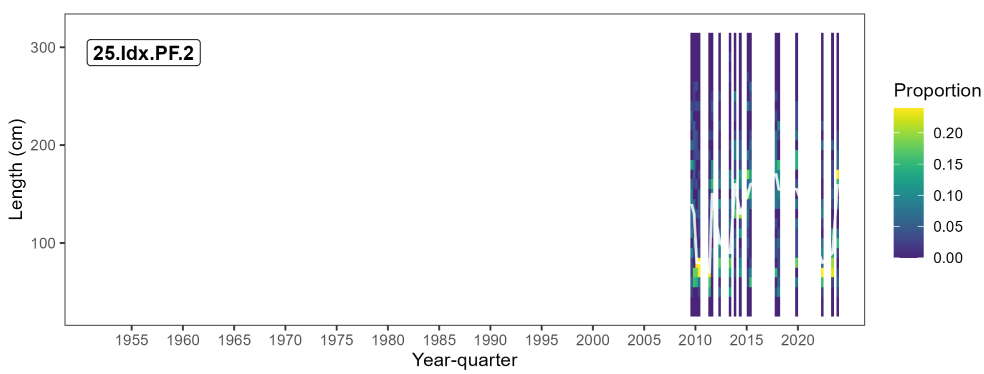


Figure C.2: Reweighted weight compositions of swordfish for the PICT index fishery options. The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

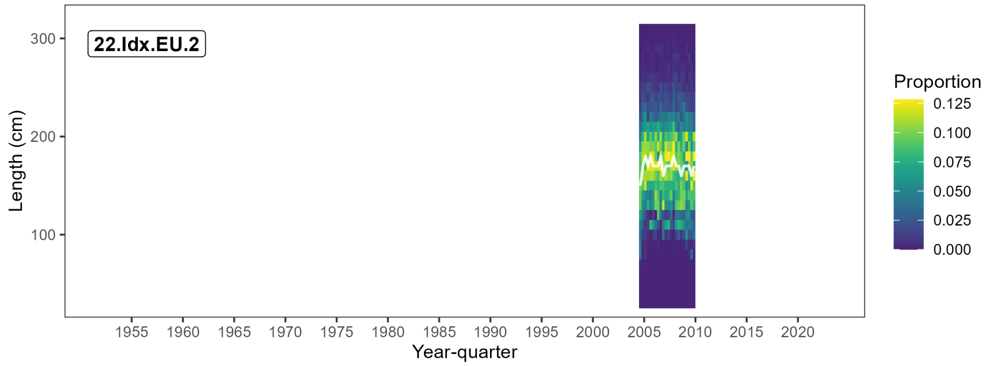


Figure C.3: Reweighted weight compositions of swordfish for the index fishery 22.Idx.EU.2. The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

D Striped marlin extraction fishery length compositions

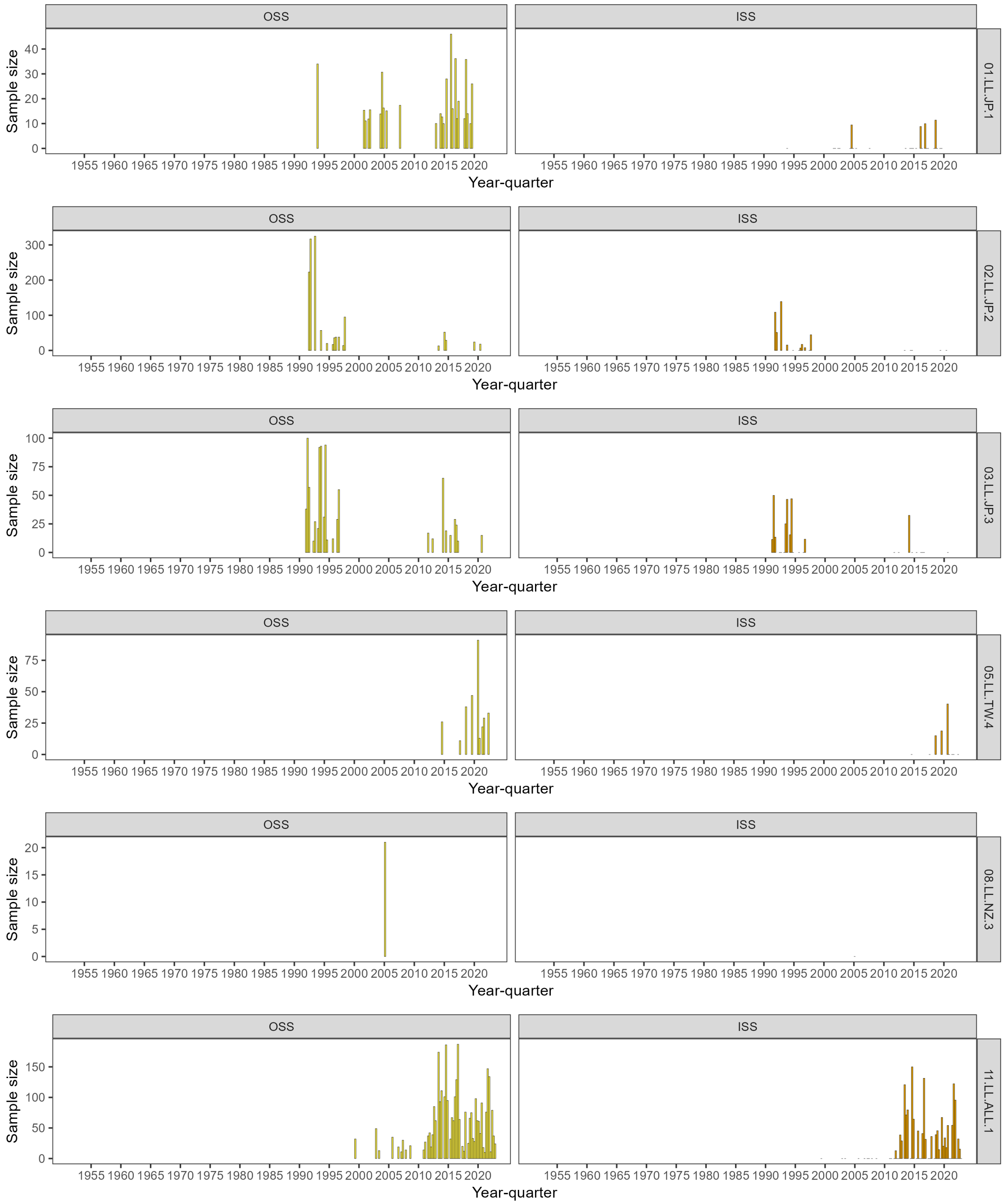


Figure D.1: Original sample sizes (OSS) and input sample sizes (ISS) for striped marlin longline extraction fishery length compositions.

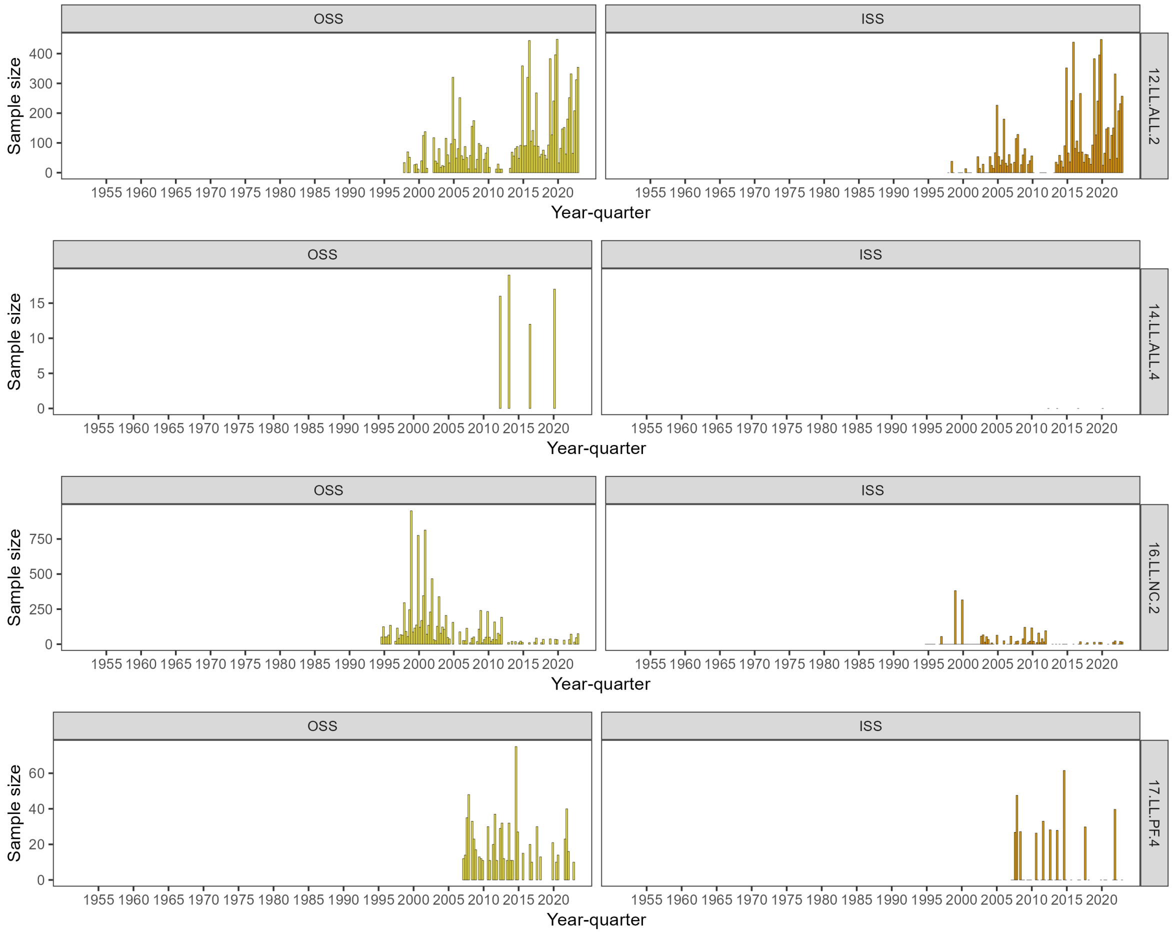


Figure D.1: Original sample sizes (OSS) and input sample sizes (ISS) for striped marlin longline extraction fishery length compositions (cont.).

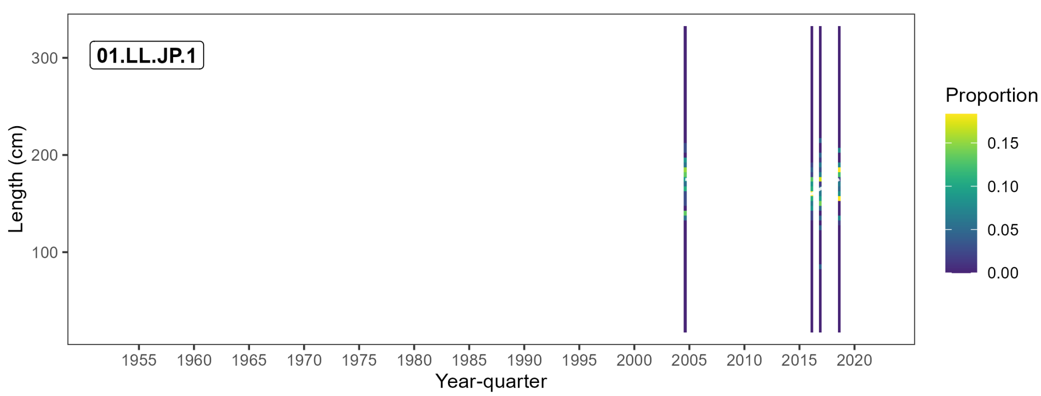


Figure D.2: Reweighted length compositions of striped marlin for the extraction fishery 01.LL.JP.1 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

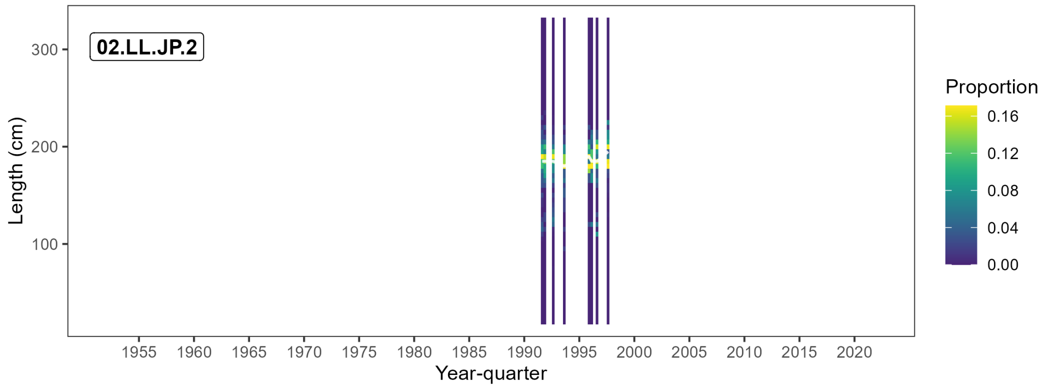


Figure D.3: Reweighted length compositions of striped marlin for the extraction fishery 02.LL.JP.2 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

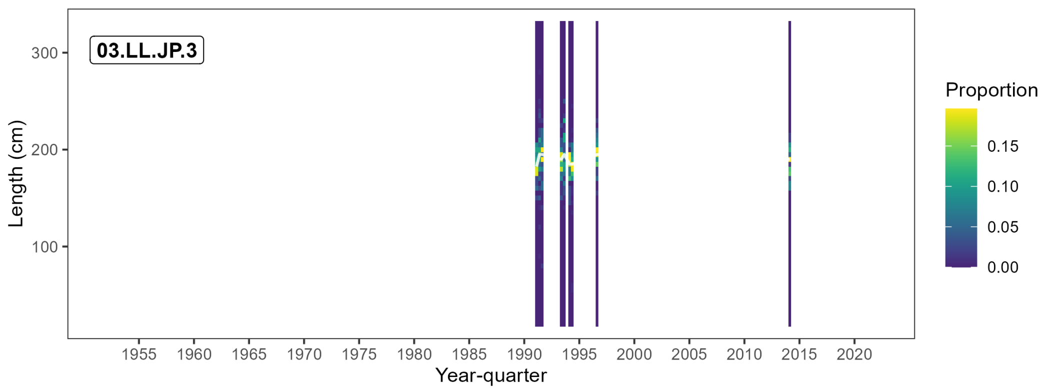


Figure D.4: Reweighted length compositions of striped marlin for the extraction fishery 03.LL.JP.3 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

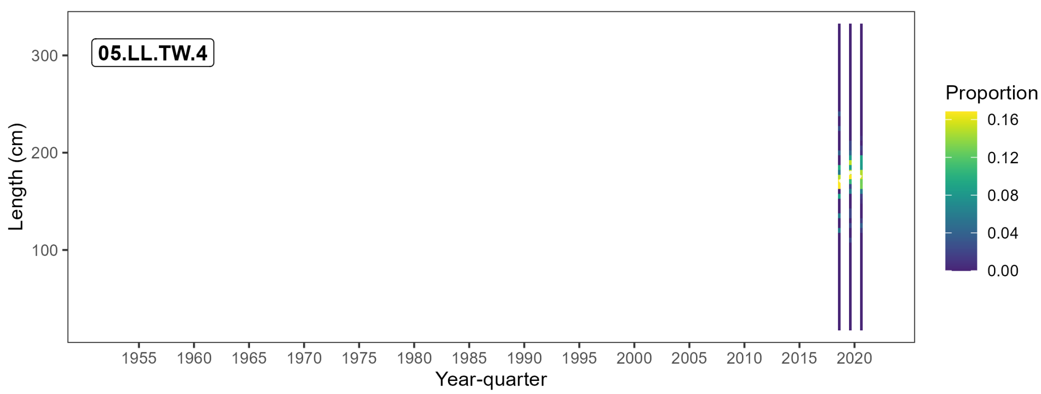


Figure D.5: Reweighted length compositions of striped marlin for the extraction fishery 05.LL.TW.4 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

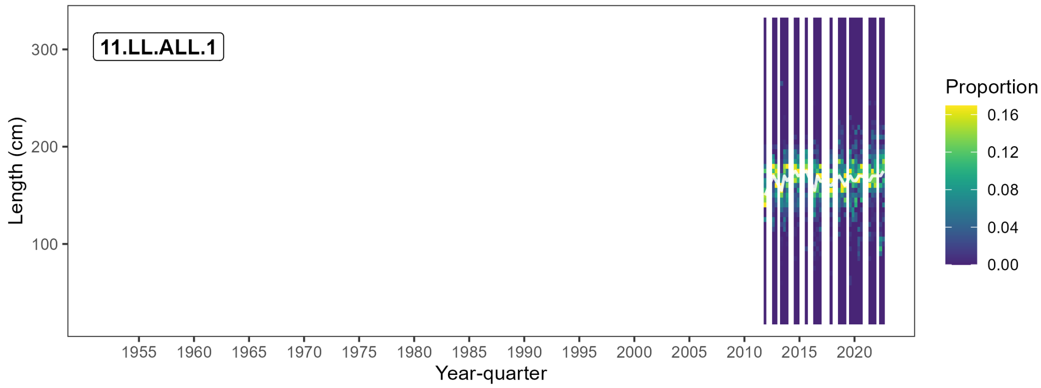


Figure D.6: Reweighted length compositions of striped marlin for the extraction fishery 11.LL.ALL.1 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

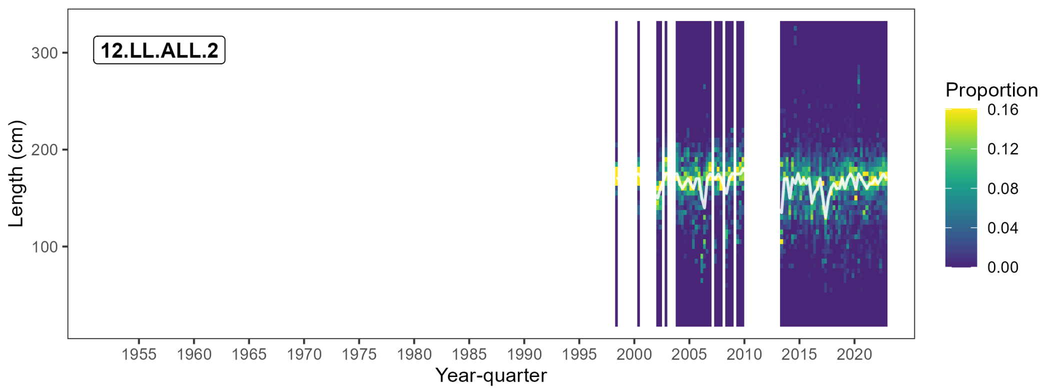


Figure D.7: Reweighted length compositions of striped marlin for the extraction fishery 12.LL.ALL.2 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

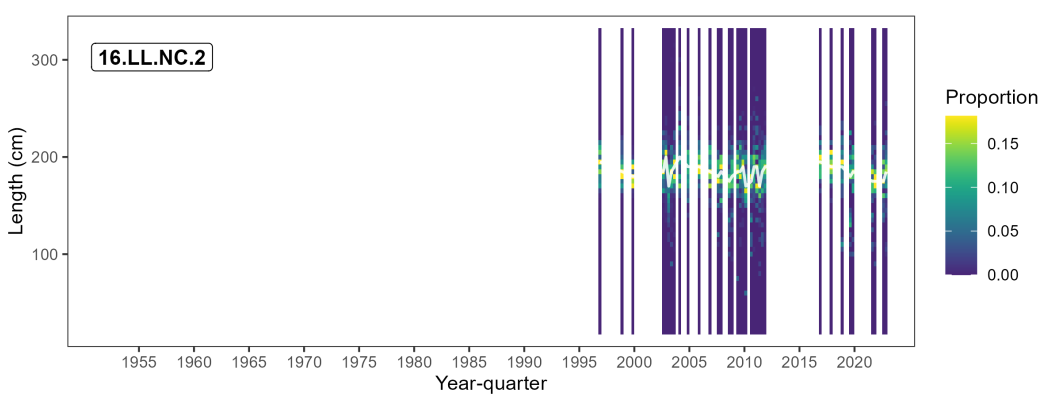


Figure D.8: Reweighted length compositions of striped marlin for the extraction fishery 16.LL.NC.2 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

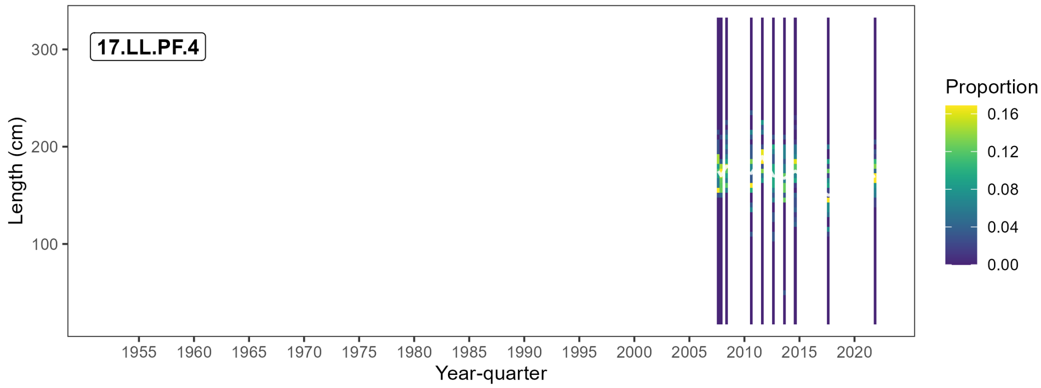


Figure D.9: Reweighted length compositions of striped marlin for the extraction fishery 17.LL.PF.4 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

E Striped marlin extraction fishery weight compositions

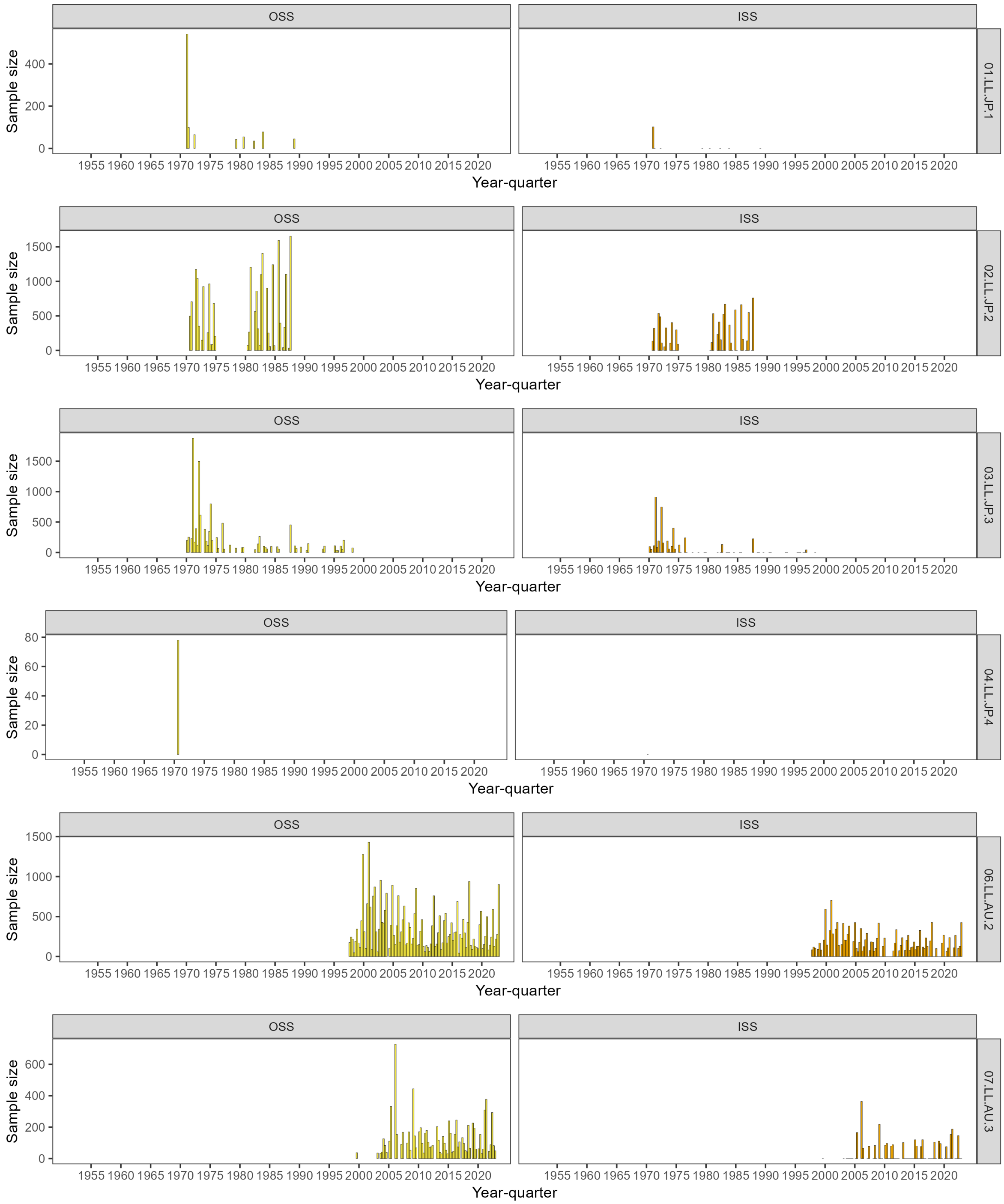


Figure E.1: Original sample sizes (OSS) and input sample sizes (ISS) for striped marlin longline extraction fishery weight compositions.

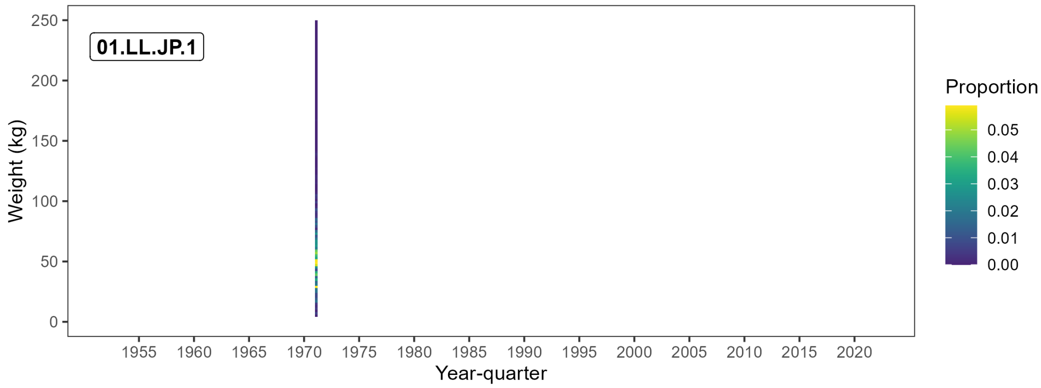


Figure E.2: Reweighted weight compositions of striped marlin for the extraction fishery 01.LL.JP.1 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

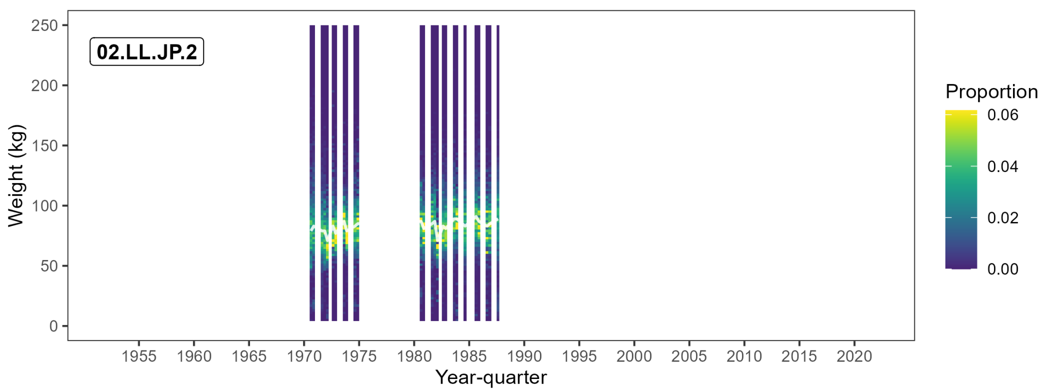


Figure E.3: Reweighted weight compositions of striped marlin for the extraction fishery 02.LL.JP.2 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

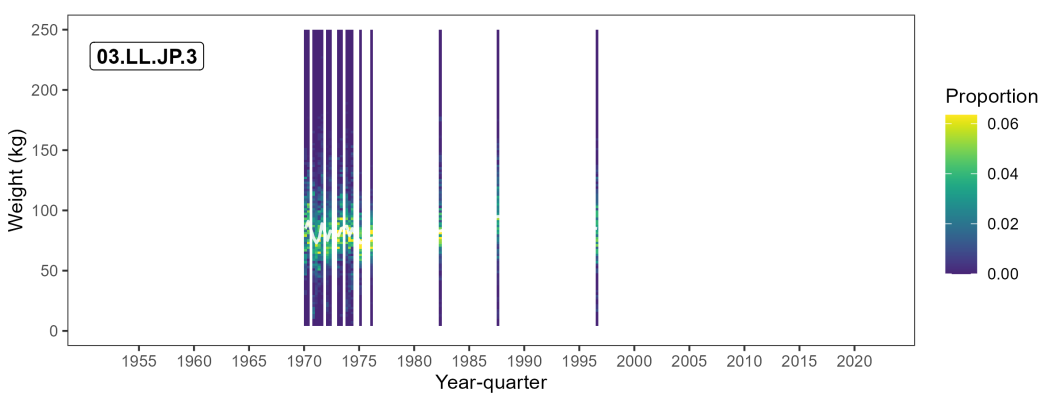


Figure E.4: Reweighted weight compositions of striped marlin for the extraction fishery 03.LL.JP.3 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

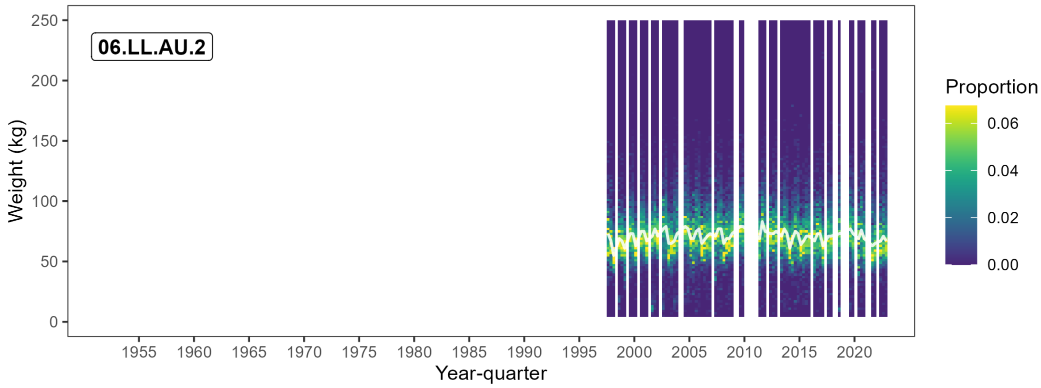


Figure E.5: Reweighted weight compositions of striped marlin for the extraction fishery 06.LL.AU.2 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

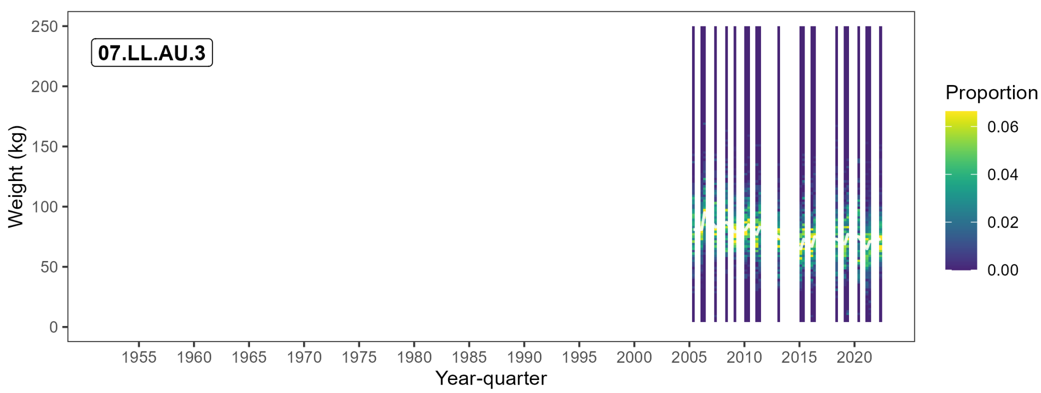


Figure E.6: Reweighted weight compositions of striped marlin for the extraction fishery 07.LL.AU.3 . The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

F Striped marlin index fishery length compositions

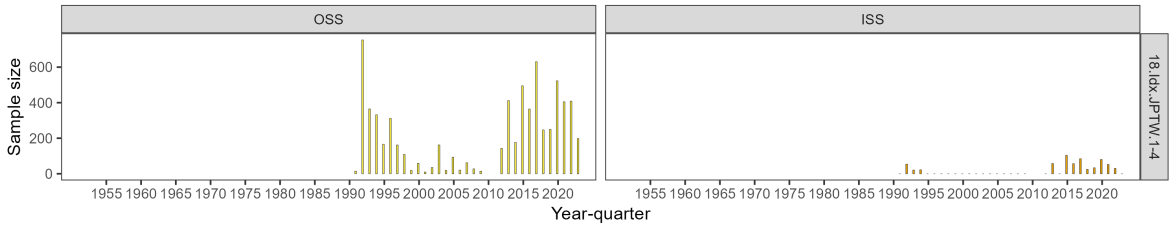


Figure F.1: Original sample sizes (OSS) and input sample sizes (ISS) for striped marlin longline index fishery length compositions.

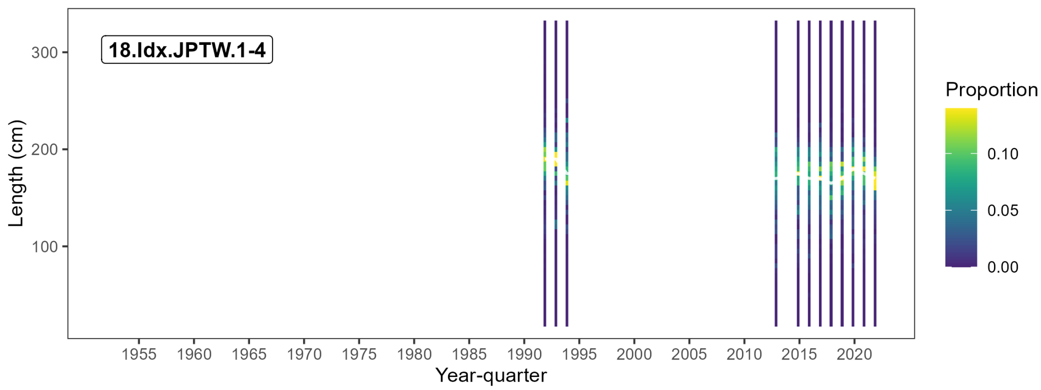


Figure F.2: Reweighted length compositions of striped marlin for the index fishery 18.Idx.JPTW.1-4. The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.

G Striped marlin index fishery weight compositions

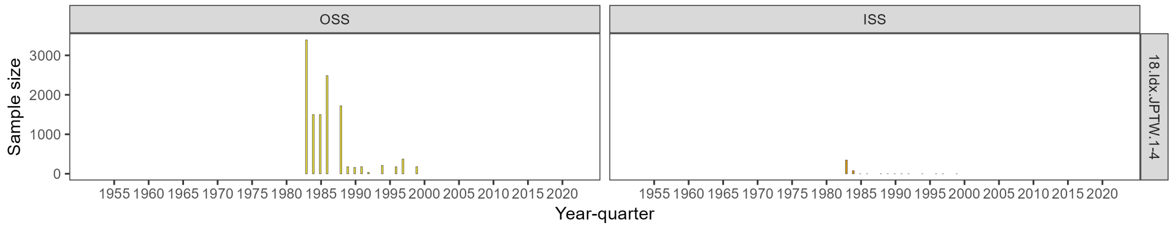


Figure G.1: Original sample sizes (OSS) and input sample sizes (ISS) for striped marlin longline index fishery weight compositions.

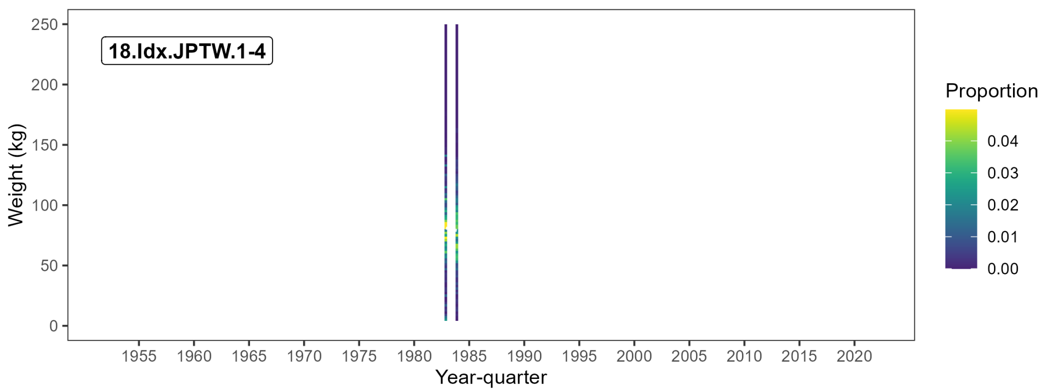


Figure G.2: Reweighted weight compositions of striped marlin for the index fishery 18.Idx.JPTW.1-4. The colour of each cell gives the proportions by size class for the year-quarter, and the white line the median size.